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TUBERCULOSIS OF THE CONJUNCTIVA.

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(*With a heliotype plate, containing five figures.*)

AN examination of the literature of the subject shows that tuberculosis may affect every tissue of the eye —the iris, choroid, ciliary body very commonly; less frequently, the cornea (Sattler, 44[1]), retina (Manfredi, 30), and optic nerve (Weiss, 52; Sattler, 44), and (secondarily) the sclera, and the conjunctiva. The frequency of its occurrence in the eye as compared with other affections has been estimated very variously. Some—as Hirschberg—place it as high as 1:6000, while others—as Mules—put it as low as 1:30,000; but even the highest estimate would make it far from a common occurrence. Of the eye-tissues, statistics show that the most frequent seat of tubercle is the uveal tract—iris and choroid,—while its least frequent occurrence is in the optic nerve and retina. Even up to 1867 the conjunctiva was thought, on the authority of Virchow (49), to have an immunity from tubercular disease. This was at a time, however, when there was thought to be a difference, pathologically, between lupus and tuberculosis, for lupus of the conjunctiva is mentioned by some of the writers before that time. The identity of lupus and tubercle is still denied by many, notwithstanding the fact that the essential pathological characters—giant-cells and bacilli—are the same in both. Neumann (33) makes this distinction, that the tubercle breaks down into a cheesy mass, while lupus does not; and cases of lupus of the conjunctiva have

[1] These numbers refer to the bibliography.

always been found, he says, associated with lupus either in the skin of the lid or other part of the body. It would seem, however, from the experiments of Trousseau (47), and Pagenstecher and Pfeiffer (34), that inoculations of the anterior chamber of rabbits with lupus from the human conjunctiva give rise to the same kind of pathological change in the iris as inoculation with genuine tubercle. This important fact, however, is to be noted, that in none of these cases has a general tuberculosis been produced. The general drift of opinion seems to be toward a pathological identity of the two affections, with perhaps some differences in the clinical manifestations. As a contribution to the further study of the subject I offer the following:

Leroy Johnson, a colored boy of fifteen years, was first seen by me at my clinic on the 29th of July, 1887. He was of a healthy but not robust appearance. No very satisfactory antecedent history could be obtained, but it was evident that he had been troubled with his eyes for at least three or four years. He had never had any serious illness, but the observation of a large scar on the left cheek, three by four inches, the lower border following the ramus of the inferior maxilla, led to the admission that he "had had scrofula" some years ago. The scar had not led to any contraction of the tissues in the vicinity, but is smooth with irregular edges, and on its lower margin there are four hard, smooth tumors which resemble the keloids to which this race is very subject. At that time the following notes were taken: L. symblepharon of both lids, the cornea not visible, being covered by the soft thickened upper lid. The lower lid was also thickened and the conjunctiva, of which a portion could be brought to view, was irregular and granular on its surface with here and there defects in its substance. What corresponded to the retrotarsal fold came up to the very margin of the cornea and was thickened and nodular. The condition of the conjunctiva of the R was the same as that of the L, only much less pronounced. The cornea could still be seen by pulling back the thickened upper lid. The corneal surface was hazy, with some vessels running over it, and vision was very much reduced. There was no considerable discharge of any kind, but strings of thick mucopus lay in the crevices of the granulations and on the edges of the lids. There was no tendency to entropion; an enlarged gland

was felt in front of the ear, on the right side, but not on the left. There was no pain complained of, nor had there been at any time. A bit of conjunctiva was cut from the lower lid of the left eye and put aside for examination. On inquiry it was learned that he was one of a family of six children, all of whom were said to be healthy. The father and mother were living, and none of their children had died.

The boy did not return until eighteen months later, when the photograph, of which Fig. 1 of accompanying plate is a copy, was taken, and the drawings, Figs. 4 and 5 were made. It will be seen from an examination of these that there is complete symblepharon on the left side, the margins of the lids coming in some places quite together. The integument, and even the edges of the lids, are unaffected, and the normal directions of the cilia are not materially altered. No portion of the eyeball was visible, but it could be felt through the soft, thickened lids, as a doughy, ill-defined mass. The symblepharon in the right eye was not so extensive, but both retrotarsal folds were entirely abolished. The thickened and nodular conjunctiva came up to and encroached upon the cornea both above and below. The corneal surface, which was still visible after the thickened upper lid was pressed back, was grayish, with thickened epithelium, and the color of the iris was barely visible through it. He could, however, count fingers at one metre when the upper lid was raised. His general health seems to be perfect. Dr. Murray, director of the clinic for diseases of the throat and chest, was kind enough to make a careful examination of his chest, and reports that he finds nothing beyond a few moist râles at the posterior portion on the right side. There is no consolidation anywhere.

No treatment has been instituted beyond a wash of mercuric bichloride, 1 : 10,000. Dr. Wm. M. Gray of the Army Medical Museum, made sections of the bit of excised conjunctiva, a photograph of one of which is shown in Fig. 2. The giant-cells are shown here with great clearness. A piece, excised later, was examined for the tubercle bacillus, and some were found in the tissue. A scraping of the surface of the diseased tissue contained many bacilli, and a photograph of a specimen, also made by Dr. Gray, is shown in Fig. 3. From a histological standpoint the genuine tuberculous character of the affection is clearly established, and the clinical history warrants the opinion that it is localized and primary.

A reference to the bibliography appended to this paper will show that the literature of tuberculosis of the conjunctiva is by no means scanty; and yet even the most recent text-books mention it either casually or not at all. The lamented Horner, in whose clinic the affection has been studied more closely than elsewhere, has considered it in his part of the treatise on diseases of the eye in childhood, in Gerhard's "Handbuch"; and Amiet's thesis (3) contains the fullest account of cases on record, up to the date of its publication. Neither Wecker (1889) nor Galezowski (1888) give cases. It is not mentioned by Sämisch, in his treatise on diseases of the conjunctiva, in the "Gräfe-Sämisch Handbuch," except as lupus. Schmidt-Rimpler calls attention to it, but says it never occurs spontaneously. Fuchs gives it considerable attention. Mooren, in his statistics of 100,000 eye cases, does not record a single instance.[1] The recorded cases are so widely scattered throughout the periodical literature of general and special medicine that we have thought it not without value to the future student to give a *résumé* of the more important facts in such articles as we have been able to consult.

ALEXANDER (2). Man, twenty-seven years, tumor of lower lid like an enlarged tarsus, conj. thickened and granular, retrotarsal fold ulcerated, a probe passing through to the bone. Conj. bulbi below in same condition up to corneal edge; remaining parts of eye intact; vision not affected.

AMIET (3). Gives the history of two cases from Haab's clinic. Case 1.—Woman, twenty-seven years; left eye. Nodules on conjunctiva of both lids, and at caruncle. Right eye normal; not seen for two years; the upper lid hung down, but not red or swollen. Pre-auricular and submaxillary glands swollen. Ulcer on conjunctiva, on temporal side of globe; retrotarsal folds thickened, granular and nodular, almost fungus-like. Upper portion of cornea pannous; anterior chamber and iris normal. Diseased tissue extirpated, and wound cauterized with platinum wire. Healing good. Some bacilli found in the excised tissue. Case 2.—Girl, of twenty-one. Outer part of

[1] Noyes, whose text-book (Wm. Wood & Co., N. Y., 1890) has appeared since this paper was placed in the hands of the printer, gives quite a long paragraph to it.

lower lid everted and nodular ; upper lid normal. Lower retrotarsal fold affected ; pre-auricular and submaxillary glands swollen. Child healthy. Removal of diseased tissue, with knife and cauterization ; return, and again removed. Healing good. Excised pieces showed tubercular nodules and some bacilli. His experiments in the inoculation of the conjunctiva of rabbits were negative. From a study of forty-seven cases recorded up to that time, he concludes : (1) That tuberculosis of the conjunctiva occurs from the tenth to the thirtieth year ; (2) generally affects women ; (3) both eyes affected about equally ; (4) seldom binocular ; (5) conjunctiva palpebrarum its most frequent seat ; (6) upper lid most frequently affected ; (7) cornea often pannous ; (8) swelling of pre-auricular and submaxillary glands nearly always present ; (9) healing can be effected through early and prompt treatment, but there are often recurrences, and when the disease is extensive not much should be expected ; (10) treatment must be surgical, removed by sharp spoon, knife, or cautery.

ARLT (4). First noticed and diagnosticated primary lupus of the conjunctiva, originating in the retrotarsal fold. It afterwards invaded the bulbar conjunctiva and cornea and lid, and later the skin of the cheek and alæ nasi.

BAUMGARTEN (5). Case 1.—Girl, of sixteen years. Ulcers of conj. of globe of both eyes encroaching on the cornea in L. Palp. conj. nodular. Diseased tissue removed with a sharp spoon ; partial ankylo-symblepharon in L. Atrophy of globe, R. Enucleation of L. Section showed conj., iris, and cornea affected with tuberculosis. Case 2.—Girl, of nine years. Conj. of lids of both eyes nodular.

CSAPODI (8). Case 1.—Girl, of sixteen. Scrofulous ; right eye : small ulcer on conjunctiva of lower lid ; no bacilli found. Case 2.—Girl, ten years. Scars on neck, and lupus of nose. Both eyes affected ; partial symblepharon in both lower lids ; palpebral conjunctiva, thickened and nodular ; conjunctiva bulbi also thickened, and the cornea invaded. No bacilli found.

ELSCHNIG (10). Man, of thirty years. Began a year before. Right upper lid thickened ; conjunctiva swollen and covered with numerous granulations and excrescences, with a tendency to ulceration. Bacilli found in tissue and scrapings of the surface.

FALCHI (11). Boy, of seven years, not robust. Ragged ulcer on conjunctiva of left lower lid ; also nodules, not painful to

touch ; slight ectropion. Affected part removed ; good cicatrization. Giant-cells found in the removed tissue.

GAYET (14). Woman, twenty-six ; right eye : conjunctiva of lid ; pre-auricular glands enlarged on that side ; nodules removed, and inoculations made in guinea-pigs and rabbits with success. The condition of the eye became aggravated, lid adhered to the ball, the cornea became involved, and the eye was removed ; giant-cells and bacilli found in the diseased tissue. Is of the opinion that it was an initial lesion.

HILL-GRIFFITH (16). Boy of four years ; right eye : entire ocular conjunctiva thickened and studded with yellowish-white infiltrations ; felt doughy to the touch ; no pain ; conjunctiva of lids and retrotarsal folds unaffected ; other parts of the eye healthy ; pre-parotid and submaxillary glands swollen on that side. Abscesses in neck and at outer commissure of the eye formed an ulcer which was thought to be lupus. No bacilli were found, but giant-cells were.

Little had seen a case somewhat similar to the above in the conjunct. bulbi left eye of a man of thirty-five years.

HAAB (17). Some of these six cases are probably among those that have been published elsewhere as coming from the clinic at Zürich. Case 1.—Man of thirty-two years ; both eyes confined to conj. of lid. 2.—Woman, eighteen years ; conj. lid of R eye. 3.—Woman, thirty-three ; L eye, conj. of upper lid. 4.—Girl of twenty-two ; conj. of L upper lid. 5.—Girl of fourteen ; conj. and retrotarsal folds upper and lower lids, L. 6.—Girl of seventeen years ; conj. of both lids, L. Giant-cells found in all. In all cases there was enlargement of pre-auricular glands. He thinks with Arlt that lupus has a tendency to pass over to the integument.

GERIN-ROZE (15). Man of thirty-four years ; conjunctiva of both lids affected ; phthisis of lungs and larynx.

FANO (12). Girl of thirteen ; operated on for squint on 31st August, 1880 ; suture used ; good healing, with no remaining hyperæmia of conjunctiva. Two months after, a gray nodule at superior internal part of the globe, which increased in size. A month afterwards the eye was enucleated, and giant-cells found in the conjunctival nodule.

HERTER (19). Grayish-yellow nodules, lower retrotarsal fold, and conjunctiva on one side. Giant-cells found.

RAMPOLDI (41). Man of eighteen years; tuberculosis of apices of lungs; ovoid ulcer on conj. of left upper lid; no giant-cells or bacilli found; removed by knife and caufery. Six months later it returned, and the patient died. No bacilli found in the conj., but plenty in the lungs.

HOCK (20). Case 1.—Boy of two years; ulcer of conj. right eye near outer angle, which began as a small nodule; went on to perforation of globe, and the child died. 2.—Man of sixty-two; ulcer of conj. upper lid outer angle of right eye. Died a few weeks after he was first seen from phthisis.

HIRSCHBERG (21). Girl of four years; ulceration of bulbar conj., retrotarsal fold, and part of the palp. conj.; cornea punctate; submaxillary gland swollen; removal; no return after three and a half years.

v. MILLIGAN (29). Girl of eleven years; conj. lower lid R eye; began as a chalazion. A year after there were nodules on the conj. of ball and lower lid, the ulceration passing over to the integument of the lid in one place; swelling in front of R ear; scraped off diseased tissue; giant-cells found. The only case in twenty thousand eye cases.

KNAPP (22). Boy of nineteen; no history of tuberculosis in family; lupus of alæ nasi; R eye healthy; L cornea and bulbar conj. healthy; nodules on palp. conj. of upper and lower lids, and some small ulcers; two large ulcers near edge of upper lid; tubercle bacilli found in excised tissue, and inoculations in ant. chamb. of rabbits were successful.

KOSTER (23). This is the first reported case of tuberculosis of the conj. It was a tumor, ulcerated, which affected the conj. of lower lid, and passed back, involving the retrotarsal fold.

LUC (24). Case 1.—Girl of eighteen; scrofulous; lupus of right nose; tumor on conjunctiva of R lower lid. It was scraped, and there was no return after two years. 2.—Lupus of nose, lips, and conjunctiva bulbi right in a girl of seventeen. 3.—Lupus of face propagated to conjunctiva in a man of twenty-five. 4.—Large lupus of nose implicating lids and conj. R in a girl. He thinks conjunctival tuberculosis is associated with tuberculosis elsewhere; lupus, with struma; pre-auricular enlargements in tubercle, none in lupus; course rapid in tuberculosis, slow in lupus.

LEIDHOLDT (26). A man of fifty years, no evidence of tuberculosis elsewhere, had ulcers on the palpebral conj. and retrotarsal fold which contained the bacilli. Eye and eyelids finally removed.

LÖWENTHALL (27). A woman, who had nursed a phthisical husband; developed, nine weeks after his death, like trachoma, which resulted in destruction of conjunctiva and cornea.

MANZ (32). Boy, two and a half years; conj. of both lids of R eye thickened and nodular; edge of lower lid destroyed at its outer half; two ulcers on upper lid; conj. bulbi also affected; pre-auricular and submaxillary glands enlarged. Child died of tubercular meningitis.

PAGENSTECHER and PFEIFFER (34). Made inoculations of anterior chamber of rabbits from a case of conjunctival tuberculosis successfully; also made successful inoculation from lupus of nose and conjunctiva. The conclusion is that lupus is a localized tuberculosis of the skin.

PARINAUD, H. (36). Girl, seventeen and a half years; ulcer conjunctiva left upper lid six *mm* long, irregular, granular, and with whitish-yellow nodules; enlargement of pre-auricular gland; had existed for three months. No history of tubercle in family, and no evidence of any in herself. Inoculation of anterior chamber of rabbits produced tuberculosis of iris and lungs.

PECK, E. S. (37). Girl nine years; ulcer, left upper lid, seven *mm* long by three *mm* broad, ovoid in shape, extending from inner canthus; granular floor, and bled easily; whitish secretion; ocular conjunctiva not affected; patient otherwise healthy; cauterized with argent. nit.; healed. Two months afterward another ulcer developed in the middle portion of the same lid, which was also healed by cauterization. Five months afterwards another ulcer at inner canthus, which invaded the integument, and a fourth at the time of report.

PFLUEGER (39). Girl of twenty years; left upper lid thickened and hanging down; on conj. an ulcer 11 x 2 *mm*; globe free; ulcer behind the left ear appeared after the conjunctival ulcer; cauterized; healed. No microscopical examination made.

RHEIN (40). Case 1.—Man of twenty-two years; L eye, total symblepharon; R conj. nodular and ulcerated in places; cornea perforated; bacilli found in discharges; successful inoculations. 2.—Girl of nineteen; L eye, both upper and lower lids nodular, with swollen conjunctiva; bulbar conjunctiva slightly so; pre-

auricular glands swollen ; bacilli found in extirpated tissue, and inoculations were successful.

SATTLER (44). In the case published in *Irish Med. Gazette* (45) he made sections of the lids, and found tubercle in the conj., subconj. tissue, and tarsus. In a more recent case a woman of fifty-six years had a tumor on the cornea, like proud-flesh, which spread to the conj. On examination after removal the characteristics of tubercle were found in the conj. and cornea.

STŒLTING (46). Case 1.—Girl of nine years ; ulcer on conjunctiva R upper lid ; granular growths at bottom, and slight corneal pannus ; pre-auricular glands on that side swollen ; mass removed, and bacilli found ; recovery apparently complete. 2.—Girl of twenty years ; typical tubercular ulcer of left cheek ; lungs normal ; double dacryocystitis, which was treated. Some months later conjunctiva of L upper lid developed an ulcer near the retrotarsal fold ; granular at bottom ; conjunctiva nodular ; pre-auricular glands enlarged. Professor Horner removed the diseased mass, and rabbits were inoculated in the anterior chamber successfully. R eye became affected some months later. There was a recurrence in the left eye. 3.—Girl of sixteen ; ulcer on conj. of left lower lid, with granular bottom ; pre-auricular glands enlarged on that side ; no tuberculosis of lungs detected ; bacilli found in tissue removed by Professor Horner, and inoculations were successful.

WALB (51). Boy. Upper and outer part of the bulbar conj. of R eye had an ulcer which finally led to perforation of the sclera.

WALB (51*a*). A case additional to (51), child one and one half years. L eye : lids thickened, but no irritation ot the eye. Thickened secretion on edges of lids. Conj. on both lids thickened with defects and nodules. Pre-auricular glands swollen and fluctuating. Cauterized the diseased parts with success. He considers that eye tuberculosis may be primary.

The important practical question in connection with tuberculosis of the conjunctiva as well as with other localized tuberculosis of the eye is, as to whether it ever is, or can be, primary, and whether the removal of the diseased part will prevent a general infection. An examination of the clinical histories of the recorded cases seems to show that while in some instances the conjunctival affection was evi-

dently secondary and in many others doubtful, there are still some cases where we must accept the conjunctival affection as the primary lesion. The proof of this is the lack of evidence of tuberculosis elsewhere and the non-appearance of the disease in other parts of the body after removal of the diseased tissue. And, after all, the real wonder is, that we do not have more frequent inoculations of the conjunctiva than we do. The experiments of Valude (48*a*) show that while the intact healthy conjunctiva may not be inoculated with tuberculous bacilli, it is, on the other hand readily inoculated when abraded. Fuchs (13) also holds the same view. Now of all the mucous membranes, there are probably none more liable to abrasions and epithelial defects than the conjunctiva, particularly in childhood and among those who are from faulty nutrition and general tendency to tuberculous disease, most liable to infection of this character. Phlyctenular conjunctivitis is the most frequent eye-disease among strumous children. When these vesicles rupture and form ulcers, they make a most favorable nidus for the bacilli, which may be conveyed into the eye with the dust in the air, or by other means, as the towels and handkerchiefs used by phthisics. And it would seem, all things considered, that this explanation of direct inoculation [1] is much more reasonable than the supposition of a secondary infection through the circulation—though tuberculosis of the interior of the eye cannot be thus accounted for so satisfactorily, except in cases of injury. I have seen several times, in young people, ulcers of the conjunctiva near the lid margin, which had all the macroscopical appearances of tubercular ulcers, and which disappeared after thorough cauterization with the pure nitrate-of-silver stick. That such ulcers may even heal spontaneously, under good hygienic management does not seem to me improbable.

When the tubercle is situated where the complete removal is possible without material injury to the visual organ, there can, of course, be no question as to the desira-

[1] Fano's (12) case is most probably one of inoculation by an operation for squint.

bility—the necessity indeed—of total extirpation; and where the function of the organ is already lost the same course will be followed. But the fact that sometimes what is apparently, or even demonstrably, tuberculosis of the eye has healed spontaneously, renders such a course not altogether so plain, particularly where the diagnosis is somewhat doubtful. In this connection I will give the brief notes of a case which I considered to be tuberculosis of the iris, which was under my observation for some time and where the nodules completely disappeared, not, however, without having left almost total loss of vision.

Harry H. was sixteen years old when I saw him for the first time at my clinic on May 22, 1885. At that time the following notes were made:

Tumor on the iris at the lower inner quadrant reaching up to the iris angle, length 2 *mm*, breadth 1 *mm;* its ant. wall lying up against the posterior surface of the cornea. Old iritis, with pupillary adhesions and deposits on ant. capsule of the lens. A leash of vessels on conj. running up to and slightly on the cornea, just over the location of the tumor. Simply p. l., in R. L E normal. There was a hard nodular tumor at upper outer edge of each orbit (enlarged lachrymal glands?).

On September 29th, it is noted that there was a small yellowish nodule at the upper outer part of the pupillary edge of the iris similar to the one just described and enlargements of the pre-auricular and submaxillary glands were observed on the right side. Occasional attacks of pain and redness. January 12, 1886. Has been on inunctions of mercury for three weeks, but no ptyalism was produced. The swelling of the lachrymal glands diminished as are also the pre-auricular and submaxillary glands. July 16th. Not seen since May. In meantime has been under homœopathic treatment. R eye: almost total abolition of anterior chamber. Iris surface entirely free from nodules; pupil small and closed; punctate opacities on cornea. At lower outer part of the iris is a white atrophic space pyramidal in shape, its base corresponding to the former position of the tubercular nodule. T—1. No pain, but it easily

becomes red; V = p. l. L eye: pupil medium, but adherent all round; surface of iris studded with yellowish nodules. At the lower periphery of the iris, at the place occupied by a large nodule, the iris tissue is drawn towards the cornea, which at that point is opaque; punctate deposits on cornea near centre. Counts fingers at three metres. After this I did not see him again, but I learned some two years after, that he was still alive, but almost totally blind in the left eye. Before the left eye was affected I exhibited him before the Medical Society of D. of C., and he was examined by a number of gentlemen who pronounced his lungs free of deposit. His general appearance while not robust was not unhealthy.

In this case, when first seen, I think few surgeons would have had the temerity to enucleate, even if the consent of the patient could have been obtained, and yet the final results as regards vision could have been no worse from enucleation than they were by the *laissez-faire* plan, and the possibility of a general infection would certainly have been lessened.

The diagnosis of the disease, microscopically and bacteriologically, is now a matter of certainty. The only diseases with which it is likely to be confounded clinically, are trachoma and epithelioma. The round yellowish nodules, with ulceration at points which mark its first stages, are sufficient to distinguish it from trachoma, particularly when taken in connection with the presence of enlarged pre-auricular and submaxillary glands which are considered by some excellent authorities, and it would seem with correctness, as constant accompaniments of tubercular affections of the eyes. Epithelioma could possibly be excluded by age, the majority of those affected with tuberculosis of the conjunctiva being young people. But the microscope will tell at once whether the diseased tissue is tubercular or not.

Explanation of Plate.

FIG. 1. Photograph from life, by Dr. Wm. Gray, of the Army Medical Museum, Washington.

FIG. 2. Photograph of a microscopical section ($\times \frac{1}{1}\frac{2}{5}$) of the excised conjunctiva. By Dr. Gray.

FIG. 3. Photograph of a bacillus found in the scrapings of a diseased tissue (x $\frac{800}{1}$). By Dr. Gray.

FIG. 4. Everted lids of the right eye, showing nodules and ulcers of conjunctiva. From a colored drawing by Dr. H. V. Würdemann.

FIG. 5. Left eye showing the ankylo-symblepharon. From a drawing by Dr. Würdemann.

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A METRIC SYSTEM OF NUMBERING AND MEASURING PRISMS.

(*Concluded from page 75 of this volume.*)

By CHARLES F. PRENTICE, of New York.

THE RELATION OF THE PRISM-DIOPTRY TO THE LENS-DIOPTRY OF REFRACTION.

SOME of the advantages of the prism dioptry, as the unit of measure for the refraction of simple prisms, having been shown, and whereas prisms are frequently combined with spherical lenses, it is here proposed to further consider the relations of the prism-dioptry to such combinations, as well as to the equivalents which are to be obtained by a mere decentration of the spherical lenses themselves.

In the accompanying figure, 8, a lens is shown with its principal anterior and posterior foci *f* and *F*, equidistant from *O*, upon the optical axis *f O F*.

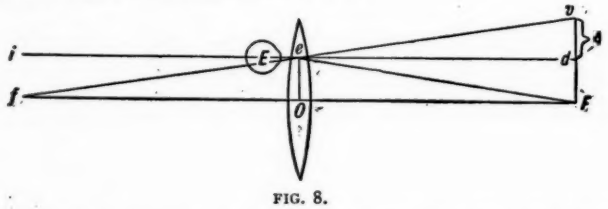

FIG. 8.

The ray, *ie*, which is parallel to the optical axis, and incident at an eccentric point *e*, of the lens, being refracted to the focal point *F* will sustain a deflection *dF*, *in the focal plane*, which will always be equal to the decentration *Oe*.

A ray, *de*, which is parallel to the optical axis and incident from the opposite direction, will be refracted to the focal point *f*, and, if received by the eye at *E*, will be projected by it in the prolongation of *fe* to *v*.

Consequently $dv = \delta$ will be the measure of the apparent displacement of the point *d*, resulting from the prismatic action inherent at *e*. By reference to the figure, and previous definitions, we then have

$$\begin{aligned} \angle dev &= \angle Ofe \\ \angle deF &= \angle OFe \\ \text{But } \angle Ofe &= \angle OFe \\ \therefore \angle dev &= \angle deF \\ \therefore \quad \delta &= dF = Oe \end{aligned}$$

The tangent deflection δ, *at the focal plane of the lens*, is therefore always equal to the amount of decentration, and consequently in direct proportion to it.

Augmented decentration of the lens will be associated with an increase in the prismatic action, resulting from a growing inclination of the tangents t_1 t_2 . . . determining the obliquity of the spherical surfaces, at corresponding opposite points of eccentricity, as shown in Figure 9.

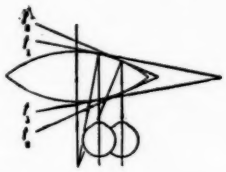

FIG. 9.

FIG. 10.

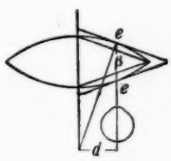

FIG. 11.

The inclination of these tangents, relatively to each other, becomes a maximum when the angle between them reaches 180°, that is to say, when they both coincide, and so form the tangent to the lens, which must then have become a perfect sphere. The amount of prismatic action it will be possible to obtain consequently only depends upon the diameter of the lens. It will be well, however, to bear in mind that lenses of large diameter, whose spherical aberration for peripheral rays causes the latter to fall short of

the focus, will naturally also effect a still further increase in the prismatic action at the focus, for an extreme decentration.

It is further obvious that a *virtual* prism of *constant* angle cannot exist within the lens to produce the aforesaid variable results. The figure, 10, is therefore apt to prove misleading, as there is but one fixed amount of decentration, *d*, Figure 11, which corresponds to a prism of the angle β, and which is determined by the tangents to the lens surfaces at *e*, drawn parallel to the sides of the inscribed prism.

Thus prepared we may proceed to a consideration of the prism-dioptry.

Supposing a lens to be 1 D, and the deflection sought to be $1^{cm} = 1$ P-D, at the meter plane, which corresponds to the focus of the lens, it would require a decentration of one centimeter to produce this result.

A lens of 2 D, being decentred the same amount, would produce a tangent deflection equal to 1^{cm} *at its focus, half a meter*, which would be equivalent to 2^{cm} at the meter plane, or 2 P- D, it having been shown that the prismatic refraction is in the inverse proportion to the distance at which the unit deflection is produced. The following tabulation will serve to make this clear.

Lens.	Decentration.	Tang. Deflections at the Focus.	Tang. Deflections at the Meter Plane.
1 D	1^{cm}	1^{cm} at 1 meter	$1^{cm} = 1$ P- D
2 D	1^{cm}	1^{cm} at $\frac{1}{2}$ meter	$2^{cm} = 2$ P- D
3 D	1^{cm}	1^{cm} at $\frac{1}{3}$ meter	$3^{cm} = 3$ P- D

This table also exhibits the fact that any lens is capable of producing as many prism-dioptries as it possesses dioptries of lenticular refraction, *provided it is decentred one centimeter.*

On the other hand the prism-dioptries will increase or decrease as the decentration becomes greater or less. Thus:

Lens.	Decentration in Centimeters.			Decentration in Millimeters.		
	1 cm.	2 cm.		1 m/m	3 m/m	6 m/m
0.25 D	0.25	0.5	Prism-Dioptries	0.025	0.075	0.15
0.5 D	0.5	1	" "	0.05	0.15	0.3
0.75 D	0.75	1.5	" "	0.075	0.225	0.45
1 D	1	2	" "	0.1	0.3	0.6
2 D	2	4	" "	0.2	0.6	1.2

A lens of 2 D, limited by its size to a decentration of 3 $^{m}/_{m}$, will afford 0.6 P-D, while a lens of 1 D, capable of a decentration of 6 $^{m}/_{m}$, will produce the same prismatic effect, as shown above. In other words, a lens of one half or one third the power will require to be decentred twice or three times as much to secure the same number of prism-dioptries.

This we find graphically demonstrated in the accompanying figures, in which the dimensions of decentration and lens curvatures are exaggerated to better serve our purpose.

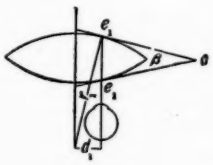

FIG. 12.

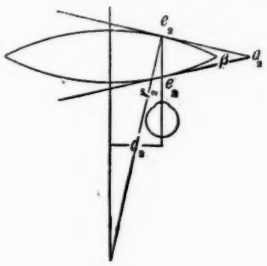

FIG. 13.

In Fig. 12 the lens of 2 D, with a decentration $d_1 = 3$ $^{m}/_{m}$, produces a deflection of 0.6 P-D *at the meter plane*, by reason of the obliquity of the lens surfaces, determined by the tangents at e_1 constituting a *virtual* prism of the angle β, with its apex at a_1.

In Fig. 13 the lens of 1 D, whose radius $r_2 = 2\,r_1$, is decentred by the amount $d_2 = 2\,d_1 = 6$ $^{m}/_{m}$, to produce 0.6 P-D *at the meter plane* by a virtual prism of exactly the same angle β, with its base at $e_2\,e_2$, and apex at a_2.

We have consequently but to remember that **the prism-dioptries in decentred lenses are in direct proportion to their refraction and decentration.**

Our present lenses will, however, not permit of a decentration of 1 ^{cm}, owing to their limited size, yet, if required, larger ones could be furnished the trade at a comparatively small increase in cost, which could be utilized specifically in corrections involving prism-dioptries.

However, in cases where the size of the lens proscribes the limits of decentration, it becomes necessary to add to it

a constant prism. Since the slightest decentration of a simple lens is certain to produce a prismatic effect, it is evident that the *constant* value of any prism, which it may be desired to add to a lens, will only be retained when the optical axis of the lens strictly coincides with the visual axis, see Fig. 14.

The effect of decentration will naturally be to increase or diminish the prismatic action of the constant prism, which has been combined with the lens.

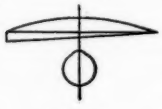

FIG. 14.

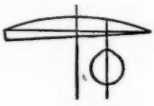

FIG. 15.

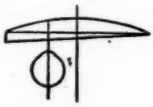

FIG. 16.

Thus in Fig. 15 the prism is increased by the prismatic action due to decentration of the lens, by shifting the visual axis toward the apex of the constant prism, while in Fig. 16 it is decreased by a decentration in the opposite direction.

Supposing a 5 D lens to be combined with a 2 D prism, the former being decentred 2 $^{m}/_{m}$, by shifting the visual axis toward the apex of the prism. We know that a 5 D lens will produce 5 P-D when decentred 1^{cm}, and therefore will produce 0.2 of 5 P-D when decentred 2 millimeters, which is equal to 1 P-D. The constant prism of 2 D has therefore been increased by 1 P.D, making it 3 P-D. A decentration of the lens to an equal amount in the opposite direction will leave but 1 P-D for the entire combination.

Two millimetres have in this case affected the value of the constant prism by 50 % of its active function.

We can now realize the importance and necessity of an accurate adaptation of spectacles, with regard to the pupillary distance, when high spherical corrections are resorted to.

The prism-dioptry and the meter-angle being directly dependent upon the pupillary distance, it behooves us, in any endeavor to secure accurate results, to be exceedingly particular as to its measurement.

Dr. Maddox, in his exhaustive work on prisms, calls attention to a unique, most simple, and accurate device for determining it.

Dr. Stevens having fully shown the disturbances occasioned by hyperphoria, I may here be permitted to call attention to the danger of artificially producing it by improperly centring the lenses in the vertical meridian in a simple case of hyperopia in which no real hyperphoria exists.

We shall admit that the lenses are decentred vertically, in opposite directions, by 5 $^{m}/_{m}$ above and below the horizontal plane, which will be equivalent to a decentration of one of the lenses by 1 centimeter, provided the other is properly centred.

Our hyperope being corrected by lenses of 2 D, would, under these circumstances, be forced to overcome 2 P-D, at the meter plane, and therefore a vertical diplopia of 12 centimeters at 6 meters, which amounts to 20 meters at one kilometer, or, approximately, in round numbers, 66 feet at a distance of 3,281 feet.

Inversely, in making Dr. Stevens' test [1] for hyperphoria, in emmetropia for instance, supposing a means to be devised to enable the patient to exactly indicate the distance between the images which he sees at a 6-meter distance. Admitting, by way of illustration, that he has decided them to be 6 centimeters apart, vertically, which, being equivalent to 1^{cm} at 1 meter distance, will lead us at once to decide that a prism of 1 D, properly placed before the eye, will correct his *manifest* hyperphoria. The same patient would have to struggle with a vertical diplopia amounting to $3\frac{1}{3}$ $^{m}/_{m}$ at a reading distance of $33\frac{1}{3}^{cm}$, being quite sufficient to cause consecutive lines of type to appear intermingled with each other.

As a third demonstration, supposing it to be desired to afford binocular vision to an emmetrope at a distance of $\frac{1}{3}$ of a meter, *without his powers of accommodation or convergence being called into requisition.* His pupillary distance being 60 $^{m}/_{m}$, for instance, half of it will be 3 centimeters, which

[1] "Functional Nervous Diseases," by George T. Stevens, M.D., Ph.D., New York, 1887, page 194.

gives us 3 P-D for *his* meter-angle, making 9 P-D requisite to set aside his convergence to $\frac{1}{3}$ of a meter, while 3 D of lenticular refraction are necessary to substitute accommodation for the same distance. A 3 D lens would require to be decentred 3 *cm* to afford 9 P-D, so that a pair of such lenses, placed before the eyes with their bases in, would accomplish the desired stereoscopic result. Two properly centred lenses of 3 D combined with 9 D prisms would serve the same purpose.

The above illustrations suffice to show the value of the prism-dioptry in leading to our conception of the actual work performed by prisms at different distances, and which the prevailing degree-system of numbering must continue to keep us in ignorance of.

Besides, a degree-system of numbering prisms cannot be brought to a *convenient* relation to any of the following points, which have been shown to exist in favor of the metric system:

1. A direct relation between the meter-angle and the prism-dioptry for variable pupillary distances.[1]

2. A direct relation of the prism-dioptry to the lenticular dioptry, for any amount of decentration of lenses.

3. Simple measurement of the pupillary distance determining the prism expressing the meter-angle.

4. All fractional intervals of the prism-dioptry being rendered available for differing pupillary distances.

5. The prism-dioptry being capable of measurement by a simple instrument, obviating it being taken for granted that the prisms have been correctly "marked."

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[1] This fully meets the suggestion of Dr. Maddox, who, in speaking of the decision of the committee of the American Ophthalmological Society, consisting of Drs. Edward Jackson, S. M. Burnett, and Henry D. Noyes, that all ophthalmological prisms should be *marked* with the angle by which they deflect rays of light, in his work entitled "Ophthalmological Prisms," on p. 30, says: "If I may be allowed to suggest it, a still better plan would be to have all prisms marked with meter-angles and their fractions, so as to correspond with lenses in the trial case, a meter-angle being the chosen unit of convergence, just as a dioptry is that of accommodation. The only disadvantage is that the meter-angle is an inconstant quantity."

It has, however, been satisfactorily shown that this seeming objection is an advantage to the new system, since the present inconstancy of our prisms can be utilized, thereby securing a degree of accuracy unattainable by any other means.

6. The resultant deflection produced by similarly placed superimposed prisms being equal to their sum expressed in dioptries.

7. Can be applied to existing commercial prisms, without increasing the cost or revolutionizing the present market.

The latter is certainly a most commendable feature, since any attempt to introduce prisms of special glass, or such that produce definite angular deviations, will heighten the cost, while depreciating the commercial value of those now on hand.

A possible objection to the new system of measuring might arise in the fact that it does not define the minimum deviation, yet, as the prisms used in spectacles are of small angles, "the difference is so trifling that it may be neglected in ophthalmic practice"[1]; and, as long as it is understood that prisms of greater angle are to be held with one side parallel with the base-line, from the eye, which is the case in measuring by the instrument, we at least obtain the desired uniformity.

In the event of it being desired to determine the resultant prismatic action of prisms which have been combined at any angle of crossing, we have but to resort to the statical formula:

$$R = \sqrt{P^2 + Q^2 + 2\,P\,Q\cos\gamma},$$

where P and Q represent the prisms, expressed in prism-dioptries, and γ the angle between their base-apex lines.

In ophthalmic practice this is apt to prove of possible value only when the prisms cross each other at right angles, consequently when $\gamma = 90°$, and therefore,

$$R = \sqrt{P^2 + Q^2}$$

The resultant prismatic refraction, R, will be in the plane which coincides with the diagonal of the parallelogram obtained by the forces P and Q.

[1] "Ophthalmological Prisms," by Ernest E. Maddox, M. B., London, England, 1889, page 11.

CASE OF CORNEAL TRANSPLANTATION FROM THE RABBIT'S TO THE HUMAN EYE; RESULT NOT VERY FAVORABLE.

By WILLIAM F. SMITH, of Chicago.

(*With two figures.*)

December 6, 1888, Mary Katus, a Polish woman, was brought to my office by her brother. She is twenty-seven years old, very delicate, and slightly built. When she was three years old she suffered from an attack of small-pox, which left her totally blind.

The bulb of the left eye is soft and partially atrophied. The corneal membrane is entirely changed into cicatricial tissue. There is no perception of light. The sightless ball diverges and is in constant motion.

The right eye is nearly normal in size and tension. A dense leucoma occupies almost the entire extent of cornea, leaving only a very narrow margin (less than 1 *mm* in width) of partially transparent membrane just within the sclero-corneal junction. There is no visible anterior chamber, the iris apparently being firmly united to the posterior surface of the leucoma. The tension is not quite normal, making it probable that the lens was evacuated when the cornea was ruptured. Light perception, however, is good and the phosphenes are easily excited.

According to Von Hipple's rules it did not seem a case for which a transplantation could be done successfully. The relatives were very persistent, however, and I finally consented to make the attempt.

Von Hipple's instrument not being available, I had one made by Messrs. Sharp & Smith, of this city—a simple trephine without spring or clock work. It consists of a cutting-cylinder 4 *mm* in diameter and 10 *mm* long. This is cup-shaped and perforated

through its bottom, the perforation furnished with a screw thread. Into this is screwed a shaft, 2 inches long, furnished with a milled head. Cutting-cylinder with shaft attached is shown at *A* Fig. 1. Over the shaft fits a metal cylinder just long enough to play

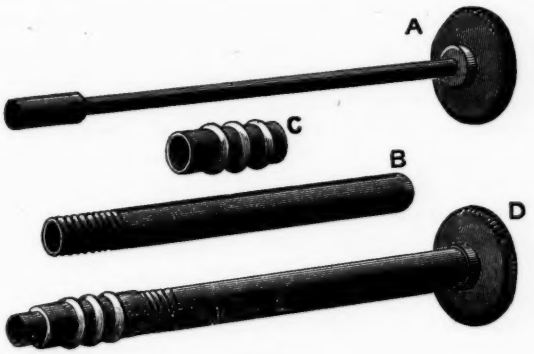


FIG. 1.

freely between the end of the cutting-cylinder and the milled head of the shaft. One end of this cylinder is furnished with a screw thread for the hood, *C*, which moves over the cutting-cylinder. Thg instrument when put together for use is represented at *D*. By means of the hood the depth of the incision may be exactly graded. The free end of the hood is square-cut. Its inner edge plays as closely as possible to the outer surface of the cutting-cylinder.

The patient was assigned a bed in the Emergency Hospital. A healthy rabbit, one year old, was procured. The operation was made December 13th. The most thorough antiseptic precautions were taken before, during, and after the operation. I was assisted by Dr. Hall and Mr. Schwann. Anæsthesia by chloroform was carried to as complete a degree as safety would allow. The patient proved a most excellent subject for chloroform, and took it kindly, with no struggle or any tendency to vomit.

The hood of my little instrument was fixed so as to expose exactly 0.9 *mm* of the cutting-cylinder. The point chosen for its action was about 2 *mm* downwards and inwards from the centre of the cornea. The instrument was held firmly with the left hand, while the milled head of the shaft was turned slowly with the right, so that the cutting edge, which was as sharp as it could

be made, sank readily and evenly into the cicatrized cornea. The button to be removed was fixed by the fixation bident, with points reversed, and drawn upwards while it was carefully cut out with a small Graefe knife. This I found to be a very delicate piece of work, but was reasonably successful. The bottom of the mortise thus made was still opaque, except in one small spot not larger than half of the area of a pin's head, and it was impossible to determine whether or not this was a remnant of the membrane of Descemet. Further efforts to clear away tissue were abandoned for fear of penetrating the bulb. There was some little bleeding from the margins of the cut, which was stilled by a few drops of a solution of boric acid. The rabbit was now slightly narcotized with chloroform, and a few drops of a 10 % solution of cocaine were allowed to fall on its cornea. The nictitating membrane, or third lid, was cut across with a strong pair of scissors, as was also the orbicularis at the external canthus. This was done to prevent interference by spasmodic action on the part of these muscles.

The hood over the cutting-cylinder was moved back so as to expose several millimetres of the free end, and an attempt was made to cut through the clear cornea at one turn of the cylinder. This failed. The division was not complete, and as it was impossible to replace the knife so that it would complete the incision, the other eye of the rabbit had to be prepared. This was done after some little delay, when the second attempt, during which several turns of the cylinder were made, was entirely successful. The button of the rabbit's cornea had been forced up into the cup of the cutting-cylinder. The instrument was taken apart, and after the shaft had been removed the cutting-cylinder was fitted into the mortise already prepared in the patient's eye, and the button of cornea from the rabbit was forced down into it by means of a wooden tooth-pick fashioned for the purpose. The transplanted membrane lodged snugly in the place designed for it. It will be remarked that its surfaces had not been handled or in any way interfered with by any harsh instrument after it had left its natural location. The eyelid was drawn down over it and held by the hand of an assistant while the patient was, as gently as possible, brought from under the influence of the chloroform. The fact before mentioned, that there had been no vomiting, was of great assistance in carrying out the details of the operation.

The importance of remaining perfectly still was impressed upon the patient. She was carried to her bed, and I think I can say

she did not move for twenty-four hours ; a trained nurse was at her side during all that time, and so assured me. To this fact, and to the gentle, tractable nature of the patient is due the perfect union that occurred, and was maintained till the healing process was complete. No bandage or packing was used other than a simple strip of gauze fastened round the head in such a manner as to hold the lids gently closed. I should have stated that the patient's face and eye had been cleaned with a boiled, saturated solution of boric acid, and with sterilized water. None of the usual irritating, antiseptic solutions had been used about the eye operated on.

For seven days the patient was kept, for the most part, in a recumbent position, after which she was allowed some liberty. The healing process seemed to be complete in about two weeks, and in three weeks after the operation she returned to her home in Streator, Ill.

At the time of leaving the hospital the transplanted piece was slightly elevated above the surrounding tissues, but the margin of union was smooth and presented no evidence of irritation. The button of rabbit's cornea had retained its transparency, but rested upon an opaque surface except at the small spot before mentioned, which was dark, and through which evidently some light reached the fundus. She could see any object held between the eye and the light, but could tell nothing about outlines. More could not be expected from one who had been so long totally blind.

About six months after the operation I was informed by the relatives of the girl that she could do "ordinary house-work" ; and a few weeks ago a paragraph appeared in a local paper to the same effect. I had repeatedly written for the parents to bring the girl to the city in order to be able to report upon the condition after so many months. For some reason they were not able to come till last week, when her brother again brought her to the office.

Her general health has very much improved. She is now robust and stout. The transplanted piece of cornea has sunk to a level with the surrounding tissues, indeed somewhat below them especially at the centre, so that it appears like a facet polished on the surface of a sphere. The tissue upon which it has grown is not any more transparent than before. The small spot still has the dark appearance that indicates partial transparence, and she

can now tell something about the outlines of objects held between her and the light. Her brother says she can tell the "chickens from the dogs and cats and other animals in the farm-yard," and that "she does considerable work about the house." The accompanying drawing, Fig. 2, is a rough sketch of the eye as it now appears to me.

FIG. 2.

The line separating the transplanted piece from the rest of the cornea is not quite as well marked as here represented, and I have failed to show the facet-like appearance spoken of. The curved line passing from the centre of the cornea downward is a blood-vessel. The spot to the left of it indicates the location of a chalk-like deposit (calcareous matter) in the thickness of the leucoma. On examining closely the transplanted portion with a lens, it is easily recognized as transparent, and the bottom of the mortise can be seen as a rough surface dotted over by very fine points of the same chalk-like deposit. In the lower, inner quadrant is seen the dark, semi-transparent portion before described.

Both the patient and her brother say that her vision is improving. For some reason the very narrow margin of cornea described as existing at the first examination near the sclero-corneal junction seems to have widened, and the blue of the underlying iris is more perceptible. Perhaps her improved general health, and consequently increased activity constitute the reasons her relatives have for believing that her vision is actually improving.

I have attempted corneal transplantation five times in hospital practice, and this is the only case approaching success. It must be acknowledged that in it the circumstances were exceptionably favorable to successful union. The result cannot be considered very favorable. It only shows that in a case of central leucoma the cicatricial tissue of

which does not include the membrane of Descemet, and where an anterior chamber still exists, a transplantation may be successful, and the transparency of the transplanted section may be maintained. But in just such a case an iridectomy would be a far preferable operation.

CHICAGO, March 26, 1890.

A SINGULAR CASE OF INJURY—BLINDNESS FROM A PENETRATING WOUND OF CHEEK AND ORBIT.

By WILLIAM F. SMITH, of Chicago.

January 2d, of this year, I was called in consultation with Drs. Lee and Murphy to see a boy who had become blind in his left eye from an accident.

The patient, twelve years old, healthy and well developed for his age, gave the following account of the injury. Himself and a few companions had been playing in a stable near his father's house. They were in a hay-loft, and he had accidentally fallen through a concealed opening to the floor below. One of his companions had been chasing him about the loft, and had in his hand a hay-fork with two tines. This fork fell, or was thrown, through the opening at the moment our patient fell, and when he reached the floor one of the tines of the fork went into his cheek. The fall in itself did not hurt him ; he was not bruised or dazed, but pulled the tine out of his cheek himself. When asked how far it had penetrated, he held up his hands so as to indicate about two and a half or three inches. He started to the house with his little friends. When he got to the door-step, he says he noticed that he was blind in the left eye. He was sure about this, because he said he had accidentally closed the right eye and found that he could see nothing at all with the other.

The mother said the boy had complained of very little pain, but being very much alarmed she had sent for the nearest doctor, who had simply put a few drops of an eye-water in the eye, the purpose of which she did not know.

The accident had happened forty-eight hours before I saw him.

Upon examining the eye we found that the pupil was dilated, but as the physician who had been first called had evidently used a solution of atropine, this was of no significance. The most

careful tests failed to show that there was any perception of light in this eye. The ophthalmoscope showed the optic mediæ perfectly clear and the circulation of the fundus normal.

On the left cheek, about half an inch below the alveolar process of the superior maxillary bone and about half way between the chin and the angle of the lower jaw, was a small penetrating wound. It could be traced upwards, backwards, and inwards entirely through the cheek. Opposite the wound in the inner side of the cheek another opening, evidently the continuation of the wound, was found in the mucous membrane over the alveolar process and near the root of the second molar tooth. There was no discharge from this opening, and we did not penetrate it to any depth. There was no evidence of fracture anywhere, yet we had to conclude that the wound was in some way responsible for the blindness. The patient showed no evidence of any inflammatory process, there was no temperature, no headache, and no symptoms of cerebral lesion.

Upon returning to the office I took a skull to examine the relation of the parts. With a letter-opener, which is a long, narrow blade, I was surprised to see that when I pressed its point against the alveolar process of the second molar in the direction of the wound we had been examining, it found its way directly through the spheno-maxillary fissure at about its centre, across the apex of the orbit, and exactly bisected the optic foramen, the point being arrested by the upper anterior wall of that foramen. Indeed, pressing the point of the instrument anywhere within half an inch of the spot first chosen, the bones of the neighborhood formed a sort of funnel, which drove the instrument directly to the optic foramen. I was therefore forced to the conclusion that the tine of the fork had actually crushed the optic nerve just where it enters the orbit.

I have since made three examinations of the patient at intervals of ten days. At the last occasion I was able to determine that the optic disc had lost some of its color. The *arteria centralis retinæ*, however, seemed as prominent as ever, and the rest of the fundus had undergone no change. The eye became considerably diverged, and was displaced upwards. The pupil was dilated to a medium degree when the other eye was covered, but reacted promptly with the other. There has never been the slightest light-perception since the accident. I shall keep the eye under observation with considerable interest.

Has any *confrère* ever heard of a similar case?

RELIEF FROM A GRAVE TYPE OF EPILEPSY FOLLOWING THE CORRECTION OF AN EXAGGERATED CONVERGENT STRABISMUS.

By CHAS H. BEARD, M.D.,

OCULIST AND AURIST NORTH STAR DISPENSARY, ASSISTANT SURGEON ILLINOIS CHARITABLE EYE AND EAR INFIRMARY, CHICAGO.

Peter Moos, aged fifty-two, a barber, a native of Germany, came for consultation to the eye and ear department of the North Star Dispensary early in March, 1888. The cause of his seeking advice was excruciating pain in the left eye, and affecting the sensory nerves over most all of the contiguous side of the face and head. This pain, which had its incipience in the eye, had been first felt some eight or ten years previous to his coming, and, recurring after shorter and shorter intervals, had grown to be almost constant. At about the same time had begun deviation inwards of the left eye, the pain and the convergence gradually increasing, one keeping pace with the other, until the one had become all but unbearable and the other had progressed to the extreme limit. It was only by a decided effort at abduction that a portion of the cornea could be brought into view. Four or five years previously the man had begun to be visited by paroxysms of an epileptic nature. These, too, had gradually increased in severity, while the intervals between the attacks had progressively shortened, till, at the time of his coming to the dispensary, their violence had become most distressing, and their frequency had attained an unwonted degree—as many as three or four, within a period of twenty-four hours, not being unusual. According to the description of them, given not only by the patient himself, but by several members of his immediate family, these paroxysms had every essential characteristic of ordinary epilepsy: falling down in total unconsciousness, convulsive movements, turning purple in

the face, stertorous breathing, frothing at the mouth, etc. There seemed, however, to be no diminution in the power of the mental faculties. Indeed the patient was a man intellectually much above the average of his class, possessing a fund of practical knowledge, besides being well up in mathematics, astronomy, and the allied sciences, and, withal, an inventor of no mean repute.

It may be well to add that there was also in this case total deafness, evidently due to disease of the labyrinth, the later dating back for its beginning some twenty-five years. Aside from the abnormalities mentioned, the patient enjoyed excellent health. The morbid eye, from having once had acute vision, had grown quite amblyopic, the retina retaining its function, and that but feebly, on the nasal side only; that is to say, objects, when held close up, could be indistinctly seen in the extreme temporal field. In all respects not mentioned, the eye was normal. Vision in the fellow eye was good, and there was no error in the refraction of either eye.

The pain about the eye was described as of a peculiar nature, chiefly a cruel pulling and straining backwards referred mainly to the side nearest the nose, and then an acute ache, extending over that side of the face and head.

The measure which seemed most obviously advisable was an operation for correction of the strabismus. The result could only be salutary if considered on no other than merely cosmetic grounds, and there was, moreover, a possibility of causing thereby amelioration of some of the more grievous symptoms. Accordingly, on the following day the patient presented himself fasting, and with the kindly assistance of Doctors Hall and Brougham, physicians to the dispensary, he was put under ether, and the operation was done. The anæsthetic was taken very badly, by the way, the man becoming, at one time, alarmingly asphyctic. We made an advancement, with a tendon resection, of the left external rectus, combined with pretty thorough tenotomy of the left internal rectus. Recovery was prompt, and the result most gratifying; for not only was there correction of the deformity, but from that time till the patient's death, which occurred from a railway accident on the 22d June, 1889, fully fifteen months later, he neither suffered from the old agonizing pain, *nor had a single fit of epilepsy.*

A significant feature of this case is to be found in the fact that, immediately preceding death, there was again a

slight tendency of the left eye inwards, and with it suspicions of pain and other uncomfortable symptoms, identical in character with those which had accompanied the former progressive convergence, began manifesting themselves. And, although nothing of an epileptic nature was ever again experienced, the morbific signs were, to the patient, so unmistakable as to create within him the keenest anxiety. I do not doubt, therefore, but that had he lived a year or two longer another, and a similar, operation would have been required.

The strabismus occurring thus late in life, the pain which bore a direct ratio to the aggravation of the squint, both having succeeded central ear disease; add to this the very happy result of the operation, and lastly the perverse tendency to secondary deviation of the globe, with its attendant symptoms,—do not all point to some disease, or source of irritation, at the base of the brain, the same causing decided lack of balance in the muscular system of the left eye, this, in turn, giving rise to reflex epilepsy?

CORTICAL HEMIANOPSIA WITH SECONDARY DEGENERATION OF THE OPTIC NERVE.

By H. SCHMIDT-RIMPLER, Prof. in Marburg.

(*With plate ix. of vol. xix., Germ. Ed., 1889, and two illustrations in the text.*)

Translated by Dr. F. H. Pritchard and Albert Bick, of Boston.

THE subjoined case is one of unusual interest, it being, as it were, an experiment upon man in confirmation of Munk's investigations as to the seat of the centre of vision in the occipital lobe, furthermore in giving us information as to the position of the nerve fibres in the optic nerve which supply the hemianopic part of the retina.

The patient in question, first received in 1882 into the surgical clinic of Prof. W. Roser, and observed by me for five years as to his sight, died in 1887, in the clinic of Prof. Mannkopff, of tuberculosis pulmonum. Already in 1882, in the Marburg Medical Society, a short report of his case was given by W. Roser and myself (*cf. Berliner klin. Wochenschr.*, 1883, 32); in the dissertation by Gerhartz (Marburg, 1885), a complete history is to be found, where especially is its remarkable course surgically considered. Prof. Marchand has also given, in the Marburg Med. Society, August 1, 1888, a detailed macroscopic description of the brain of this patient. The microscopic examination will be the subject of a dissertation to appear later.

H. Muhm, thirty-three years of age, received February 22, 1882, from a blow with a spade a comminuted fracture of the posterior portion of the **right parietal bone** a few centimetres below the sagittal suture. At the bottom of the wound in the skin, which was 5 *cm* long, running from in front backwards, with smooth, gaping edges, several splinters directed deeply inwards were visi-

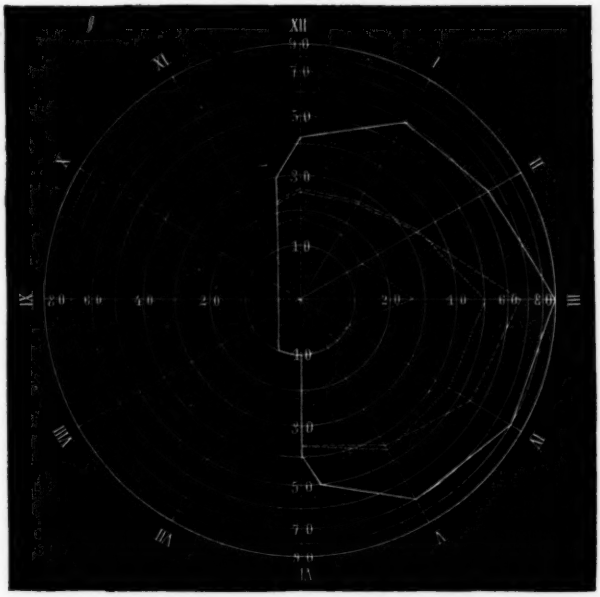
ble. On the 23d of February the skin wound, in which there was was brain-substance, was enlarged and several splinters of bone were removed with the chisel. The dura mater was torn in several directions in a spot the size of a one-cent piece. For five days there was fever and icterus, followed by a normal condition. April 7th the wound had closed with the exception of two small and profusely suppurating fistulæ, and the patient could leave his bed. April 21st he became worse again ; sopor. The fistulous wound was enlarged, a cerebral abscess opened, and about a table-spoonful of pus removed, whereupon consciousness returned. The protruding fungus was finally removed with the scissors. May 4th, there was an aggravation with coma, accompanied with paralysis of the left arm and leg. Up to May 18th the cerebral prolapse increased in size ; it was pencilled daily with chloride of zinc. Pieces of brain substance, the thickness of one's finger, were several times taken away. From the 19th of May the paralysis of the left arm and leg decreased, and finally disappeared with the exception of a feeling of weakness in the left arm. In the course of the next week the wound covered itself with skin. The patient had observed, according to his own statement, as soon as he regained consciousness, a disturbance of the sight of the right eye, which he noticed the more *as he had already lost the sight of the left eye in his ninth year in consequence of an injury.* A large adherent leucoma was the result, and the eye was amaurotic.

An examination in the surgical clinic of Dr. C. Roser revealed a **left-sided hemianopsia of the right eye.**

I examined the patient July 14th, and measured the field of vision of the right eye with Scherk's perimeter. A nasal hemianopsia was found. The line of separation did not pass perpendicularly through the macula, but, as is more often observed, it extended about 5°–8° beyond the point of fixation, and in the upper part of the field of vision also it projected somewhat beyond the vertical. The temporal part of the field of vision had normal boundaries ; also for colors. At the first examination of the field of vision the area sensitive to green seemed somewhat contracted, but later was found to be of normal size, so that this variation may be ascribed to inaccurate statements of the patient, a difficulty experienced to a certain degree even in accurate observers. In the course of the following years a series of perimetric experiments was made. Aside from the variations just mentioned,

the extent of the visual field remained the same, even in the examination made a short time before his death, as the following illustrations show :

Right Eye.
Field of Vision : July 14, 1882. June 2, 1884.



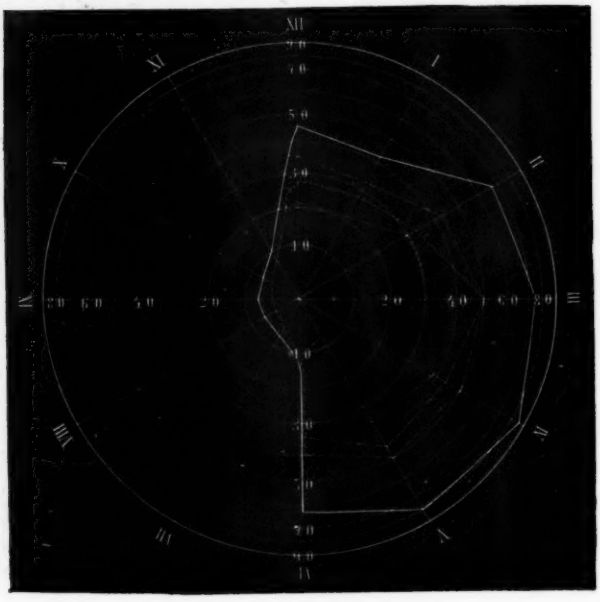
——— white. —. —. — red.
- - - - blue. . . . . green.

FIG. 1.

The central visual acuteness of the emmetropic eye was normal and remained so. The P. proximum lay at six inches. The sense of light, examined with Förster's photometer, showed no disturbance. Externally the eye was normal ; the ophthalmoscope also revealed no pathological changes. The optic papilla, as to color and amount of blood, was apparently normal ; the temporal half appeared somewhat paler ; yet this cannot with certainty be regarded as morbid, the pale color corresponding to the site of the physiological excavation. In the course of time a small part of the lower border seemed to have become somewhat paler than

formerly. The pupil was of moderate size and responded to light. Alternate shading and illuminating of the hemianopic part of the retina yielded varying and uncertain results as to the reaction of the pupil.

Right Eye.
Field of Vision: Feb. 15, 1886 (examined with a white ball).



Feb. 15, 1887 (examination with colors).
Aug. 25, 1887 (slight deviations from that of February).
FIG. 2.

In the latter years, however, a greater difference was perceptible in the contraction of the pupil when light was thrown with the ophthalmoscope upon the nasal or temporal side; in the former the reaction was less marked, but yet it could be seen.

The patient, after the wound had healed, resumed his occupation and remained free from any paralysis or central disturbances. Yet sometimes his head would "get warm," and he would then be obliged to sit down; he did not have any real attacks of faintness or spasms. His memory is said to have become somewhat

weaker. Sensation in the left hand was reduced. Hearing was good ; with his left ear he heard the watch not as well—at about half a metre—as with the right, there being a moderate catarrh of the middle ear. In February, 1887, symptoms of **pulmonary phthisis** showed themselves, to which he succumbed on the 17th of September (of the same year) in the medical clinic. At the **post-mortem** examination the brain was removed with the piece of bone attached to the cranial wound, so that it could be hardened *in toto*. The left optic nerve was flat, much thinned, and discolored on section ; the condition in question was clearly that of a centripetal atrophy originating in the left amaurotic eye. On section of the right optic nerve at the optic foramen a difference was distinctly visible between the color of the intensely white marginal part and the more grayish-white trunk. The left tract was much thinner than the right.

After complete hardening in Müller's solution and alcohol the right cerebral hemisphere, after previously sawing through the piece attached, was cut through in the direction of the sagittal suture about 3 *cm* from the median fissure. According to Marchand's communication, the section presented the following conditions : "The bone defect, situated in the posterior part of the right parietal, is 4 *cm* long. It is closed by a firm cicatrix, which is closely united with the brain to the same extent : the dura mater is lacking in this region. The right hemisphere is 3 *cm* shorter than the left, in consequence of a great diminution in size of the occipital lobe. The anterior border of the adhesion lies about 2 *cm* behind the interparietal fissure, the apex of the occipital lobe extending 1½ *cm* posteriorly beyond the place of adhesion. In the entire region of the latter the cerebral mass of the convexity is totally absent. The posterior horn of the right lateral ventricle is greatly distended (1½ *cm* broad), and in the region of the defect is distorted upwards, its inner surface covered with several folds. The space between the ependyma and the outer cicatrix was occupied by thick and quite fibrous cicatricial tissue, which also extended over the medullary substance of the apex of the occipital lobe. Within it there was found, between the floor of the posterior horn and the gray cortex of the under surface, a smooth cyst about the size of a hazel-nut ; this cyst was the product of softening. Only a very small part of the medullary substance in the outermost point of the occipital lobe was still to be found ; also the gray cortex to the same extent in

the portion not yet affected of the lobe. Anteriorly, atrophic remains of some convolutions could still be recognized, embedded, however, in cicatricial tissue, the medullary substance being completely gray and sclerosed.

The medullary surface of the occipital lobe was partly adherent to the dura mater, and hence cannot be seen freely, but apparently it was sunken and shrivelled; it was in its full extent down to its lower border shrivelled, while on the external circumference of the convex surface the convolutions were still intact.

The right optic nerve, hardened in Müller's solution and alcohol, was divided into sections from the optic foramen to the eyeball; only a very small piece of the nerve lying near the optic foramen was used to make a longitudinal section. Differences in color could be seen, even in transverse sections of the nerve taken from the fluid used in hardening, as brighter and darker portions were distinguishable. The former were shown to be atrophic by Weigert's method of staining, which was principally employed; specimens were also prepared with nigrosine, carmine, and hæmatoxyline. The normal bundles of nerve fibres appeared blackish or dark blue respectively upon using Weigert's method, and were of the usual size; the atrophic ones were lighter, while more or less scattered darker rings were found in a yellowish tissue lying between; they were much smaller in size. The connective tissue lying between the bundles of nerve fibres, which was colored brown, showed in the atrophied portions a narrower network, without broadening any of the septa. In longitudinal sections larger globular deposits, with a blackish contour, were found in the atrophic nerve-fibre bundles. Staining with hematoxyline revealed the free nuclei in larger numbers in the atrophic portions of the nerves; but this may be explained by the disappearance of the nerve substance and the closer approximation of the nuclei. The position of the atrophic nerve fibres supplying the temporal half of the retina, which, if one accept semi-decussation, correspond to the uncrossed fibres of the tract, was varying; in the vicinity of the optic foramen they appeared as a narrow seam, which surrounded about one half of the periphery of the nerves the middle of this crescent pointing inwards and downwards, *i. e.*, towards the nasal side. The temporal point extended only to the lower part of the temporal border of the nerve, while the nasal side, on the contrary, was but little removed from the uppermost point of the periphery of the nerve (*cf.* Plate ix., Fig. 1). Nearer

to the eyeball a change took place (*cf.* Plate ix., Fig 2) ; in the vicinity of the point of entrance of the artery a wedge of healthy nerve substance penetrated into the inner lower atrophied periphery of the optic nerve (*cf.* Plate ix., Fig. 3). On coming nearer to the eyeball this part became broader (*cf.* Plate ix., Fig. 4), so that at the point where the vein enters, a broad transverse band of normal substance passes directly through the optic nerve, bounded above and below by a peripheric crescent of atrophic substance (*cf.* Plate ix., Fig. 5). This position of the peripheric crescents, both of which encroached somewhat upon the temporal side, was also apparent close to the eyeball ; the temporal portion of what had remained healthy of the nerve was larger than the nasal (*cf.* Plate ix., Fig. 6). The region of the lamina cribrosa was worthy of notice, inasmuch as the medullated nerve fibres first disappeared in the centre ; finally two wedges of dark-colored nerve bundles remained, a larger one on the temporal, and a somewhat smaller one on the nasal side, while at the periphery only a few dark dots could be found (*cf.* Plate ix., Fig. 7).

This case is an addition to the larger number of observations which support the view of Munk as to the seat of the centre of vision in the upper part of the cortex of the occipital lobe ; but scarcely any other shows with such clearness the traumatic destruction and its consequences. The injury affected the right occipital lobe, in its upper part, and soon after the left-sided hemianopsia was diagnosticated. At the post-mortem examination, only the outer extremity and the temporal convolutions of the occipital lobe were found unattacked by the suppurative processes following the injury. The nasal hemianopsia of the right eye—unfortunately the left one had been amaurotic since childhood—remained unchanged, with complete central visual acuteness during the following five years, up to the death of the patient. The secondary degeneration, an extension of which into the optic nerve Monakow and Siemerling have also recently observed in cerebral processes, extended through the optic nerve to the eyeball. It gives us certain information as to the position of the nerve fibres supplying the temporal half of the retina. They occupy in the vicinity of the optic foramen the whole lower periphery, a large part of

the nasal and only the lowest part of the temporal side of the optic nerve. After the entrance of the vessels they lie more on the upper and lower periphery, extending especially from above and upon the temporal side; the nerve fibres supplying the nasal portion of the retina push themselves in between. If we compare herewith the position of the nerve fibres supplying the region of the macula as ascertained by Samelsohn, Vossius, Bunge, and others, which nerve fibres in the vicinity of the optic foramen lie in the centre of the nerve, but after the entrance of the vessels form a wedge with its base towards the temporal periphery, which position they maintain near the eye, we shall come to the following conclusions in regard to the distribution of the nerve fibres in the optic nerve. In the vicinity of the eye the fibres supplying the macula lie in a wedge-shaped bundle on the temporal side of the nerve, the fibres of the temporal portion on the upper and lower periphery encroaching somewhat upon the temporal as well as the nasal side, the fibres of the nasal portion in a part embracing the centre of the optic nerve and the middle third of the nasal half of the periphery in the neighborhood of the optic foramen, the fibres, which supply the temporal portion of the retina, occupy the lower periphery of the nerve, a larger portion of the nasal and a small lower one of the temporal periphery; those supplying the nasal portion of the retina occupy especially the upper periphery, a larger part of the temporal and a smaller upper one of the nasal periphery, whilst the macular fibres are found more in the centre.

As regards the position of the uncrossed bundle of fibres, as it was found in our case, the results obtained thus far are not uniform. But in the communications of Uhthoff[1], Jatzow[2], and Siemerling[3], which particularly come into consideration here, pure hemianopsia is not in question, so that the assertion that the uncrossed fibres should lie upon the *lateral* side of the nerve seems to me not to be proven; nevertheless individual differences are possible. It must

[1] *Graefe's Arch.*, xxxii., Nos. 3 and 4.
[2] *Graefe's Arch.*, xxxi., No. 1.
[3] *Arch. f. Psychiatrie*, xix., No. 2.

also be considered that the secondary degeneration may be incomplete, and, further, that we cannot speak in a mathematical sense of an upper and lower part in the case of the optic nerve. In the case of Uhthoff, atrophy of the outer lower quadrant of the retina was found. The position of the fibres in our case agrees on the whole with that in Uhthoff's preparations (*cf.* Table V., Fig. 8). Even Siemerling, who states that the fibres of the uncrossed bundle in the trunk of the optic nerve lie laterally, reaching the periphery with the larger part of their circumference, in the orbital portion more below, shows in his Fig. 6 (beginning of the entrance of the central vessels) and Fig. 7 (about 5 *mm* beyond the entrance) no essential deviation from our results; the healthy uncrossed fibres lie principally below, although partially also in the centre. As in his case, besides the reduction of the central acuteness of vision, the greater part of lower nasal quadrant of the visual field had lost its perceptive power, as well as the outer half of the visual field, it will be easily understood that the portion of the optic nerve lying more to the nasal side, which according to my results belongs likewise to the uncrossed bundle of fibres, is shown not to be preserved in his transverse sections. The longitudinal sections, into which Siemerling has divided the optic nerve near the eyeball, do not seem, according to the cuts, to entirely confirm my results as regards the position of the uncrossed bundles. It is, however, difficult to form as exact a picture from the three longitudinal sections as can be done from the transverse sections, as the one passing through the upper part of the optic nerve still falls into the papilla, and therefore cannot show the upper periphery of the nerve. Finally, the fact should be once more emphasized that the case in question was not one of pure temporal hemianopsia, and that the central visual acuteness when last recorded, on November 21st, was only $\frac{15}{200}$. Death ensued on December 27th, and in the intervening time probably still other disturbances of vision took place. (On December 3d the record says: The patient opened her eyes a little, but apparently could not see the person addressing her.)

The relation of the pupil to the action of light is also

interesting. At the beginning the reaction was about the same, whether the percipient or the blind half of the retina was illumined. Later a difference in the extent and rapidity of the reaction of the pupil was noticeable, but the reaction was not entirely wanting, even when only a circumscribed portion of the blind half of the retina was illumined with the ophthalmoscope. The unavoidable diffusion of light comes here into play, and renders every such reaction unreliable. The explanation of this varying reaction of the pupil must be sought in the fact that, in the beginning, conduction in the optic nerve was unimpaired to the point at which the reflex in the corpora quadrigemina is transmitted, but later was destroyed in consequence of the secondary degeneration of the nerve-fibres.

Explanation of the Illustrations.

Figs. 1 and 6 were drawn by Dr. Weinbaum, the specimens being thirty-three times magnified. Fig. 1, of the size of the microscopic picture; Fig. 6, in a somewhat reduced size. In Figs. 2, 5, and 7 only the outlines and position of the healthy in contrast with the atrophic portions are shown; the former is shaded, the latter is left blank. Transverse sections are drawn, as seen from in front. The temporal portion is therefore to the left, the nasal to the right, of the observer. Fig. 1 represents a transverse section from the vicinity of the optic foramen, the following sections successively nearer to the globe. Fig. 7 corresponds to the vicinity of the lamina cribrosa, where already a large part of the healthy nerve-fibres appear unmedullated.

A CONTRIBUTION TO THE THEORY OF THE MUSCULAR RELATIONS OF THE EYES.

By D. H. SCHIÖTZ, of Christiania, Norway.

Translated by Dr. J. A. Spalding, Portland, Me.

(*With seven wood-cuts in the text.*)

WHEN the image of the object that we are gazing at falls simultaneously on the macula lutea of both eyes, we obtain simultaneous vision (fusion) with both eyes, because our central visual organ is so arranged that the images in the two eyes can only be comprehended as one. But in order that the image of an object at which we are looking can be depicted in the macula of both eyes, it is absolutely indispensable that the ocular muscles shall cause the visual lines of both eyes to intersect at the point upon which we are fixing our gaze. In other words, *the intersection of the visual lines must coincide with the point of fixation.*

After we have once attained the capacity of fusing the images of the two eyes, simultaneous binocular vision becomes an involuntary necessity, so that we stretch to their utmost extent the muscles of our eyes in order to maintain this simultaneous binocular vision whenever at a later period of life any thing interferes with the exercise of this function that has once become habitual and physiological.

Hence we see objects at a distance, as well as those near to, with both eyes together. The nearest point upon which, by the greatest possible exertion of the interni, we are able to converge the eyes, is the *near point of simultaneous binocu-*

lar vision (fusion near point). Hence our far point for simultaneous vision with both eyes (fusion far point)[1] *must be that point at which our visual lines intersect when we exert our externi to their utmost.*

We thus obtain *a range of simultaneous binocular vision* (amplitude or range of fusion) which embraces the space between the near and the far points of simultaneous vision (Nagel).[2]

In order to be able to investigate the muscular relations of the eyes, we must first know the precise position of these points.

The investigation of the fusion far point will of course coincide with an investigation of the abductive capacity of both eyes for distance and the method to be employed is the following: Whilst the patient observes an object (a candle or light, or as I prefer a vertical black stripe 2½ *cm* wide on a white background) at least 4 *m* distant, stronger and stronger prisms with the bases inward are brought before one of the eyes until the object appears double. The strongest prism with which the patient can still see the object single, and which he can "overcome" by diverging the eyes as much as possible, gives the angle between the visual lines in prismatic degrees.

The authorities differ in the strength of a prism that can be overcome by normal eyes, A. Graefe giving from 2°–5°, whilst Beselin [3] gives as high as 6°–8°. Since using a prismatic apparatus, which I will soon describe with a succession of prisms 2° apart, I have found that the maximum prism amounted to about 8°, and more rarely 10°, or 6° with the object at 4 *m*.

The *fusion far point* for normal eyes, therefore, equals a prism of 8° with *the base inward, i. e.*, the prism 8° with base inward is the strongest one that the divergence of the eyes can overcome in order to maintain simultaneous binocular vision, whilst the angle between the visual lines, presupposing that the position of the eyes was parallel, will meas-

[1] We have left this expression in the translation, though the well-known term "binocular fixation" seems both simpler and clearer.—H. K.

[2] *Graefe-Saemisch*, Bd. vi., p. 489.

[3] THESE ARCHIVES, xiv., 200.

ure 4° since the angle of deviation for the incident beam of light measures but one half of the angle of the prism, at least in the prisms that we employ.

Our fusion far point in normal conditions is therefore a negative one; it lies about 1 *m* behind us.

Strictly speaking, some correction is necessary, because our visual lines are not parallel when viewing an object at 4 *m* distance, but they converge and form an angle of 53′, which really ought to be deducted from the above-mentioned angle of 4°, but practically speaking it need not be considered.

The fusion near point, or the nearest point to which we can converge whilst maintaining simultaneous vision, is simply determined by measuring how near to the eyes we can see a small object without perceiving double images. We use an illuminated point which is most easily obtained by holding toward the light a screen with a minute hole. I use the apparatus shown in Fig. 1; a thin black iron plate, a little larger than a playing card with a pin-head perforation in the middle. The aperture must be sharply defined as the cross-section *b* in Fig. 1 shows. Beneath the hole is a fixed tape divided into a centimetre scale.

FIG. 1.

The patient stands in front of a bright window and holds the screen in front of him. As he fixes upon the point of light the screen is brought nearer and nearer, keeping the

light point steadily in the middle point between the two eyes, until the former begins to appear double. By moving the screen a little closer or a little farther away, we easily find the point where the patient can maintain simultaneous binocular vision, and then we measure with the tape the distance between the screen and the external canthus. In this way we measure approximatively the one side of a triangle which is formed by the visual lines and the line between the rotation points of the two eyes, the base line, whereupon the angle of convergence, *i. e.*, the angle between the two visual lines can be reckoned for any given base line.

Landolt's dynamometer, constructed for the same purpose, has a metallic hat, with a minute hole in one side, that can be placed over a flame and then turned till the light shines through. Below is a metrical tape for measuring the angular distance.

The fusion near point for normal eyes is about 6 *cm*, when measured in this way, but as the distance between the eyes is about 6 *cm*, we have a convergence of about 60° between the visual lines.

If we find a fusion far point about 1 *m* behind us, and a fusion near point 6 *cm* in front of us, we get a range of fusion embracing not only the space in front of us extending from infinity up to 6 *cm*, but also partially the space behind us, that is to say from infinity to about 1 *m*. We call the former range our positive, the latter our negative range of fusion, or the amplitude of convergence and the amplitude of divergence.

Just as we speak of an amplitude of accommodation and transform it into dioptries, so can we speak of an amplitude of fusion and express it in degrees. Our entire range of fusion amounts to about 63°, about 60° for the space before us, and 3° for the space behind us.

In addition to the degree, we have another larger unit, which we can often practically employ as a measurement in our investigations.

Nagel (*Graefe-Saemisch*, Bd. iv., p. 478) suggested the idea of using the metre-angle as a unity, *i. e.*, "the fusion-

angle for an object at a distance of one metre." The angle of fusion in this case is the angle which the visual line forms with its original position when the eye has rotated inward in order to arrange itself at the distance of 1 *m* from the object which lies in the middle line between the two eyes, that is to say, the angle "a" in Fig. 2.

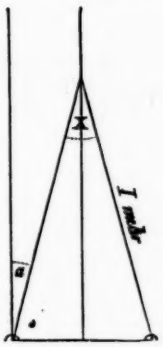


FIG. 2.

When, however, we speak of simultaneous vision, we have to consider the movements of both eyes, therefore, as I think *the angle of convergence between the visual lines of both eyes* for an object at a distance of one metre, is to be styled the metre-angle—that is, the angle $x = 2a$.

An angle of two metres will consequently be the angle of convergence between the visual lines for an object $\frac{1}{2}$ *m* distant, etc., etc.

The size of the metre-angle depends upon the distance of the rotation points of the eyes. Nagel averages this distance in adults at 64 *mm.* But since our investigations often include younger persons, I have ventured to take it at 61 *mm.* With this value, the metre-angle—*a*—will be 1° 45′, whilst the metre-angle *x*, *i.e.*, the angle of convergence between the visual lines for an object one metre off will be $3\frac{1}{2}$°, which is convenient for reckoning.

A prism of 7° will therefore coincide with a metre-angle. If prisms could only be ground according to the metre-angle system, it would be of great practical value, and

mechanically I do not suppose that there would be any difficulties in the way.

Fig. 3 exhibits the curves for the metre-angles.

Our range for simultaneous vision will measure about 18 metre-angles, 1 for our negative, and 17 for our positive range of simultaneous vision.

With normal muscular relations, however, our visual lines

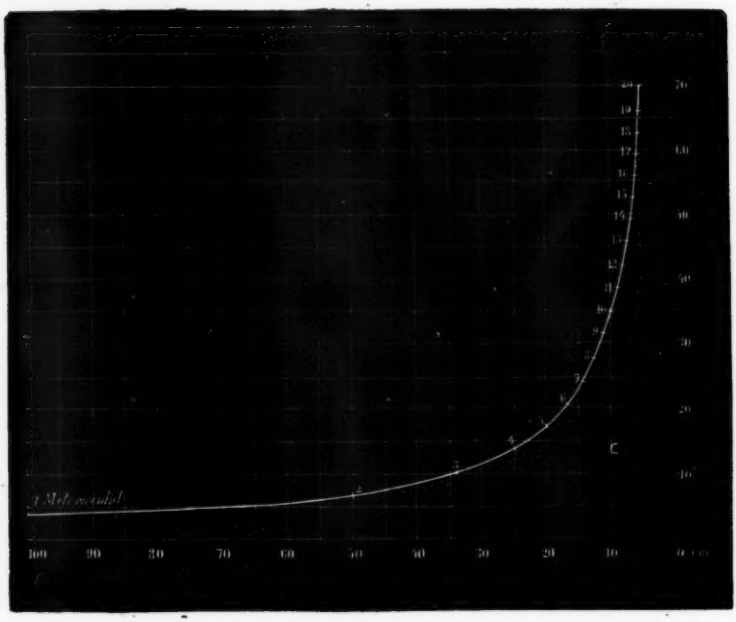


FIG. 3.

are not only compelled to intersect in the fixation point, if we are to see with both eyes, *but the same thing must happen if one eye is excluded from the visual act.*

If an object is fixed, and one eye is covered with the hand, the latter is obliged to remain in its position behind the covering hand, neither moving inward nor outward; *equilibrium must exist for the object-distance.*

A preliminary investigation of the relations of equilibrium is easiest made with the covering hand. We let the patient fix an object at the distance for which we wish to investigate the equilibrium, and we cover one eye, *e.g.*, the left eye, with the hand. On removing the hand and covering the right eye, we observe whether the left eye remains quietly in its fixation position, and then we either find equilibrium, or a movement of the eye outward or inward, in order to arrange itself anew upon the object, which proves of course, that the eye has not maintained its position behind the hand, but when excluded from the visual act it deviated inward or outward, and so far as the object distance is concerned has converged or diverged. Having observed how the left eye behaved, we again cover it and watch the right eye, a procedure which can be many times repeated.

If equilibrium is not present we must next discover whether simultaneous vision is still intact.

The patient fixes the object as before and covers one eye with the hand and then removes it, without then covering the other eye, and now we examine whether the eye at once arranges itself for simultaneous vision, or whether it remains in its incorrect position and as it were delays to arrange itself. The simultaneous vision is then in greater or less degree "*dissolved.*" Since only one eye shows this sluggishness in arranging itself, we must investigate both eyes in the same manner.

Equilibrium exists for all distances from infinity to 10 to 12 *cm*, provided that the muscular relations are normal. We therefore obtain an *equilibrium far point* in infinity, *an equilibrium near point* at a distance of from 10 to 12 *cm*, and *a range* (*amplitude*) *of equilibrium.* (Mesoropter. H. K.)

The equilibrium far point lies somewhat within the far point for simultaneous vision, the equilibrium near point slightly outside the near point for the same.

The visual lines when arranged for the equilibrium far point are parallel, when arranged for the equilibrium near point, they form a convergence angle of from 30° to 35° *i.e.*, 8½ to 10 metre-angles. The amplitude of equilibrium is

somewhat smaller than that of simultaneous vision, and lies slightly within the limits of the latter.

A more accurate determination of the conditions of equilibrium is to be made by v. Graefe's test of holding a prism of at least 10° with its *base downward* before the left eye, *e.g.*, when we have double images which vary so much in height that they cannot be fused into one. But when binocular vision is abolished, the eyes arrange themselves according to the equilibrium between their muscles, and if this is normal, the visual lines will still intersect in the fixation point. If we now employ a flame, for distant testing and a black point on a white ground or an illuminated point for a near test, the patient will see two lights or two dots or points *directly above one another*, the upper one of which will belong to the left eye.

If, however, equilibrium for distant objects is lost, the double images will not lie directly over one another but *obliquely above one another*. If convergence is present in proportion to the distance of the object, we shall have homonymous images—the upper one, that of the left eye, will stand to the left and above the lower image, whilst in divergence, which produces crossed double images, the upper light will be above and to the right of the lower one.

If equilibrium is absent we must next discover how much the visual lines deviate from the position of equilibrium. The usual way is to bring in front of the eye (the right eye in this case) stronger and stronger prisms with the base outward in convergence, and with base inward in divergence, *until the images stand directly above one another*, when we shall have in prismatic degrees the convergence or divergence of the visual lines in proportion to the distance of the object.

This method is satisfactory for long distances, but when they are short, we get too great values, especially with divergence. And at all events the method is clumsy and takes much time.

If instead of a light or point we employ a horizontal ruler divided off into centimetres we shall see two rulers when we hold in front of the left eye a prism of 10° with its base downward, and if the eyes are equally balanced, the two

rulers will stand one directly over the other. If convergence is present, the upper ruler will be pushed to the left; and if divergence prevails, to the right, in relation to the lower one. Then as the ruler is divided into centimetres we have only to note by how many centimetres the upper ruler is pushed one way or the other over the lower, when we have at once the direct deviation from a position of equilibrium expressed in degrees.

I have used this method for years, and found it as practical as it is convenient.

I generally examine the equilibrium for three distances; 3.45 *m* (5.75 *m* if the room is large enough), 1.15 *m*, and 0.286 *m*. We can now divide the ruler for distances of 3.45 and 1.15 *m* into whole or half degrees, or into metre-angles, or, as I have found most suitable, into centimetres, because I then can employ the ruler for both distances. My ruler is 1 *m* long and 7 *cm* wide, and can be hung over the back of a chair with hooks. It is white with black lines, for every 2 *cm*, so that every second stroke goes clear across the ruler.

It occasionally happens that the prism of 10° is not sufficient for 1.15 *m*, in which case we place a stronger prism in front of the eye, or an additional weak prism in front of 10°, till the difference in height is so great that there is an open space between both rulers.

FIG. 4

There is no need of subdividing the ruler according to the tangent to the angle for so slight a distance as we need. Thus for 15° the arc of a circle with a radius of 3.45 *m* is 90 *cm*, and the tangent 92.4 *cm*, which is of very slight account in our investigations.

The ruler is to be placed in such a way that its *left* end stands directly in front of the patient, and is the one to be looked at. He must then say whether both ends of the two

rulers that he sees stand directly one above the other, or whether the upper one is longer or shorter than the lower, *i.e.*, whether the upper one is pushed to the left or to the right in comparison with the latter; and if this is the case he must count off by how many long strokes on the ruler the upper one is longer or shorter. The dislocation in centimetres is then transposed into degrees.

There is generally but little difficulty in reading off the ruler. If the dislocation is extreme, and the patient is a child, counting off the strokes at the greater distance is somewhat difficult, but if we pass a cane vertically along the ruler to and fro, the patient can generally tell how much the lower ruler projects beyond the upper. For this reason in case of convergence, the right-hand end of the ruler is the one to be fixed.

For these reasons where the displacement is extensive, the examination ought not to be carried on at a distance farther than 1.15 *m*. The displacement at this distance is much less, and the legibility of the lines greater.

At 0.286 *m*, I use a thick horizontal stroke on a white card board, divided into centimetres.

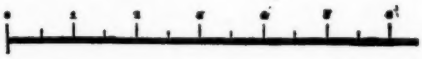


FIG. 5.

The figures above the strokes are about the size of Jaeger I., so that we can be sure that when the patient sees them distinctly his eyes are really arranged for the proper distance. In this test a displacement of 2 *cm* will correspond to 4°, one of 4 *cm* to 8°, etc. The line must be 10 to 12 *cm* long.

The tests for equilibrium are of the greatest importance, and these, in combination with the determination of the fusion far point and fusion near point, form in my opinion the only useful foundation for the determination of the muscular relations of the eyes.

I will now exhibit a short list of cases with normal muscular relations:

1) Student of medicine B. H.

+0.5 ; +0.5

$< \frac{10}{10}$ $< \frac{10}{10}$

5.75 metre . . . . . o
1.15 " . . . . . o
0.286 " . . . . . o
Fusion far point Pr. 8°
Fusion near point < 6 *cm.*

2) Student, F.

" " " ; " " "

$\frac{10}{10}$ $\frac{10}{10}$

5.75 *m* . . . . . o
1.15 " . . . . . o
0.286 " . . . . . Div. > o
Fusion far point Pr. 8°
" near " 6 *cm.*

3) K., æt. 33.[1]

52° — 0.5 ; 145° — 0.5 — 5.5
3.45 *m* Conc. 3 *cm* = ½° with — 4.4
1.15 " Not measured.
0.286 ° Conv. < o: with — 3 ; — 3
Div. > o: without lens.
Fusion far point Pr. 8°
" near " 6 *cm.*

4) Miss K., æt. 18.

0° — 1 — 6 ; 150° — 0.75 — 6.5

$< \frac{10}{10}$ $\frac{10}{10}$

3.45 *m* . . . . o with — 5 ; — 5
1.15 " . . . . . Not tested.
0.286 " . . . . o without lens.
Fusion far point Pr. 8°
" near " not measured

5) A. B., æt. 16.

" " + 5 ; " " + 5.5

$> \frac{10}{10}$ $> \frac{10}{10}$

Has lenses + 4 : + 4 to read with : lately used constantly.

3.45 *m* Conv. 3 *cm* = ½°
1.15 " " o
0.286 " " o
Fusion far point Pr. 8°
" near " 11—12 *cm.*
} Without lens.

3.45 *m* Conv. 2 *cm.*
1.15 " " o
0.286 " Div. > o
Fusion far point Pr. 6°
" near " 12 *cm*
} With + 4 : + 4

We can include amongst the cases with normal muscular relations not only those in which the equilibrium is absolutely normal, but those with an insignificant variation one way or the other, provided that they do not surpass one half a degree.

It would be superfluous to mention that by the mark < > we mean that the value discovered approximates the one given.

We must therefore arrange three formulæ according to the equilibrium for the distance, which I will call *the static position of equilibrium*, viz.:

[1] For the explanation of these symbols see these ARCHIVES, xv., p. 203. It is the designation of the meridians according to Javal-Schiötz. The number with a degree is the deviation of the axis from the vertical meridian on the right side; the next number is the strength of the cylinder in dioptries; the third, the spherical glass in dioptries. The number below is the visual acuteness; on the left of the " ;" is the left, on the right, the right eye; the glass seen from behind.—H. K.

(1) The parallel equilibrium position.
(2) The divergent equilibrium position.
(3) The convergent equilibrium position.

The two latter conditions may offer difficulties. But even with parallelism for distance, we often see difficulties for near work, muscular asthenopia. Before entering upon this topic I will describe my prism apparatus, and mention the examination of the capacity for ab- and adduction.

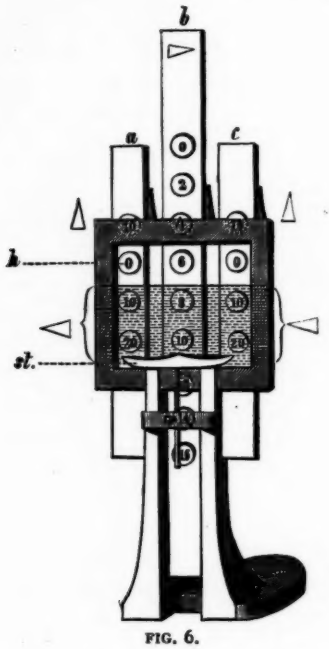


FIG. 6.

Fig. 6 shows the apparatus from behind. The three staves with prisms *a*, *b*, and *c*, can be pushed up and down, and remain fixed by means of a spring. The figures give the number of the prisms, and the triangular figures show the position. The eyes of the patient look through "*o*" "*o*" opposite "*h*." The horizontally shaded portion is closed with a thin plate in order to prevent chafing the glasses.

When the patient supports his chin upon the left side of the rest "*st*," so that he can look through the prisms in *a* and *b*, prisms as high as 36° with the base *in*, can be pushed in front of his eyes: 20° in front of the left eye and 16° in front of the right. If on the contrary he places his chin to the right, and looks through the prisms in *b* and *c*, prisms with their bases *outward* up to 36° can in turn be brought in front of his eyes: 16° in front of the left eye, and 20° in front of the right.

The equilibrium tests are begun by pushing the staves entirely down, so that the prism 10° with its base downward and the "*o*" opening are in the middle, so that the prism can be placed at pleasure before either the left eye or the right.

There is no need of wasting further words upon the apparatus; it is plain, that the examination must be more rapid and accurate when this is employed than when we are obliged to exchange and arrange each prism with our hands.

The investigations of the fusion far point and near point have given us a glance into the absolute capacity for ab- and adduction on the part of the eyes, or, as we used to say, the capacity for convergence and divergence.

It is also of great importance to fix the relative capacity for divergence and convergence for a definite distance, and we have consequently chosen 4 to 6 *m* for the longer distance, and 0.33 for the shorter, employing as a test a flame or a vertical black stripe on the wall; for near test we employ a black stripe on white paper.

After bringing stronger and stronger prisms before one or both eyes with the base inward for determining the divergence, and with the base out for determining the convergence, we find the strongest prism which the patient can overcome, still maintaining binocular vision.

If we wish to use Snellen VI for 6 *m*, or Snellen 0.5 for 0.33 *m*, we find that the limit for distinct vision is far from coinciding with the limit for simultaneous binocular vision, at all events not in the convergence experiments.

We will next refer to the relation between convergence and accommodation.

Let us imagine that we have a young emmetrope with good accommodation; his range of accommodation will about coincide with the range of convergence, and for the same object-distance, he will accommodate about as many dioptries as he will converge in metre-angles. Thus, for example, with the object at 33 *cm*, he must accommodate 3 dioptries and converge 3 metre-angles.

Accommodation and convergence are, however, not generally so narrowly connected with one another. We find, particularly in prism experiments, that the same patient whilst maintaining his accommodation at 3 dioptries, *i.e.*, whilst still maintaining his distinct vision, can converge a great deal more than 3 metre-angles. He can converge up to 6 or 8 or even more metre-angles, and on the contrary he can reduce his convergence, that is to say, he can diverge in proportion to the distance of the object up to one half a metre-angle or even up to his fusion far point.

In the same way, as we shall find by experiments with concave and convex lenses, whilst maintaining his convergence of 3 metre-angles, he can accommodate up to 6 or 7 dioptries, and again relax his accommodation down to 1.5, or 1, or even to 0 dioptries.

We find, in other words, that for a definite arrangement of accommodation, there is a relative amplitude for simultaneous vision, the convergence amplitude of which amounts to from 3 to 5 metre-angles, and depends upon individual variations and the situation of the fixation point, and the divergence amplitude of which rotates somewhere about the 3 metre-angle.

If we test the capacity for convergence on the part of these emmetropes for 6 *m* with a lamp flame, we shall approach the limit of his relative convergence for 0 dioptries when we come to a prism of 15°, 20°, or 25°. Then must arise a struggle between the distinct, and the simultaneous binocular vision. If the patient cannot abandon distinct vision, he can no longer converge, and with stronger prisms double images will arise. In this case we thus discover his relative capacity of convergence for 0 dioptries of accommodation. To judge from the values that are given as normal for

distances of 4 to 6 *m*, I feel justified in assuming that generally this relative capacity of convergence is fixed.

If, on the contrary, binocular vision conquers, the patient abandons distinctness of vision, and accommodates and converges more and more, and it will then depend chiefly upon practice (if the muscular relations are normal) how strong prisms he can overcome. Personally I have full control over my convergence, and I think that I can bring into play my entire capacity of convergence. I have never had at my command a combination of prisms higher than 90°, but this I can easily overcome.

This was the case with Em. But with Hm, or M, the relations between accommodation and convergence are different. In M the range of accommodation is pressed more or less toward the near point of the range of fusion; in Hm the range of accommodation is pushed out toward the fusion far point, and even partly beyond. In both, the convergence for a distance of 4 to 6 metres will stand in an entirely different relation to the accommodation, than in Em, and this must influence the result of the investigation. Yet any test which can be influenced as well by exercise as by the condition of the refraction, and a struggle between binocular vision and distinctness of vision, cannot have much if any value.

I carried on these tests for a long time, but found the results so varying, the gain so doubtful, and the time employed so enormous, that I abandoned them.

Alf. Graefe[1] gives the following values for the capacity of convergence and divergence:

Distance > 4 *m*.	Distance 33 *cm*.
Div. Pr. 2° — 5°.	Div. Pr. 5° — 10°.
Conv. Pr. 20° — 30°.	Conv. Pr. 30° and over.

Beselin[2] has found greater values for the divergence and smaller for the convergence, as well as Reich, whose results are noted by Beselin:

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[1] *Graefe-Saemisch* Bd. vi., p. 41.
[2] These ARCHIVES, vol. xiv., p. 219.

Beselin—Div. Pr. 6.2°.	Div. Pr. 11.5°.
Conv. 13.2°.	Div. 20.2°.
Reich—Div. 5°.	Div. 15°.
Conv. 15°.	Conv. 24°.

The capacity of divergence for distance coincides with the determination of the fusion far point, which corresponds generally to a prism of 8°.

I have discovered convergence for distance as high as 30°, and as low as 18°, 14°, 12°, with entirely normal muscular relations.

I have not tested so fully for the near point, but I have found the capacity for divergence from 7° to 16°, and for convergence from 16° up to 70°.

These extreme variations show that we have not yet found a stable foundation for determining the muscular relations.

It has, however, been asserted that the relation between divergence and convergence with normal muscular relations ought to be about $\frac{1}{3}$, but the figures given by A. Graefe do not show such a proportion, and, so far as my investigations go, there is some such proportion in some cases, but not in others. One circumstance, however, is often discovered, that when the proportion is greater than $\frac{1}{3}$, or even than $\frac{1}{4}$, an increased capacity for divergence or defective capacity for convergence will be present.

Great stress has been laid upon the importance of the accommodation for the convergence, but I think that this has been exaggerated.

If we have a Hm of 4 D, an Em, and a M of 4 D, we find that the Hm must use 6 D of accommodation for an object 50 *cm* away, the Em 2 D, and the M no accommodation for the 2 metre-angles of convergence, which are needed to arrange the eye for the object. The convergence angles, always constant for any fixed distance, are therefore united in various cases with variable quota of accommodation, which depends upon the refractive condition of the eyes. On the contrary, constant quota of accommodation must appertain to the determined angles of convergence in every individual case.

When, however, in the above examples we correct the Hm and M with the respective + and — 4 D lenses, and the proportion once existing between accommodation and convergence is suddenly deranged, what then occurs? The patient will feel uncomfortable for a short time, since he must employ for the same metre-angle of convergence a suddenly different quota of accommodation. For this reason he will at first have difficulties, be obliged to determine slight variations in distance, and must, *e.g.*, pass carefully up and down stairs, but these difficulties soon disappear since the accommodation and convergence quickly adapt themselves to the new relationship.

I will later speak of the influence which a sudden derangement of the relations will exercise upon the convergence when binocular vision is absent.

The necessity for simultaneous binocular vision compels us to converge correctly; by it we learn to converge a 2 metre-angle for an object at a distance of ½ a metre, and 5 metre-angles for an object ⅕ metre distant. And the accommodation? Well, that has to arrange itself accordingly. A person with Hm 4 D may learn how to use 6 D of accommodation for 2 metre-angles of convergence. If emmetropic, he may learn how to employ 2 D of accommodation, and with myopia of 4 D he has to learn how to converge for 4 metre-angles without any accommodation.

In order, however, that definite angles of convergence shall always belong to definite distances, "*a sensation of convergence*," as Alfred Graefe has entitled it, will develop itself, and so far as the accommodation is concerned, a so-called "sensation of accommodation" will develop itself according to the relations existing in the given case between the accommodation and the object distance.

To this sensation of accommodation we owe the disagreeable feelings which are perceived when the once arranged proportion between convergence and accommodation is suddenly deranged. For a given distance (convergence) an accommodation must now be employed which was formerly employed at a different distance, and this must influence our judgment of various distances until we have accustomed our-

selves to a correct appreciation of the condition of affairs, *i.e.*, until the adaptation between the accommodation and convergence is again established.

I must be able to judge of the distance by means of the "sensation of convergence," but I cannot comprehend that with the same I could also regulate my convergence as some believe. The sensation of convergence cannot, of course, have any influence upon the *accommodation* convergence.

There is, however, one influence, which, in addition to the necessity for simultaneous vision, must play a certain rôle, and this is the "consciousness of nearness," as first suggested, so far as I recall, by Hansen Grut.[1]

I will take the liberty of calling it the "consciousness of distance," because I shall then embrace objects at every distance.

The consciousness of distance is developed by exercise and experience, generally under the associated action of convergence and accommodation, though we see also that it is influenced by both, but it must be regarded as chiefly independent of these. We observe particularly, that even the one-eyed have a consciousness of distance. Although they are obliged to dispense with the fine shades of difference at short distances (which belongs to binocular vision and by means of which Hering's gravity test alone is possible), yet they are never in doubt whether an object is one metre distant or only half that distance.

We must owe this particular consciousness of distance to our capacity of being able to judge the situation of an object in proportion to its surroundings, according to the mutual size, position, and distinctness of the retinal images, as well as from our knowledge based upon experience of the size and situation of the objects. And this consciousness must be of considerable importance for our convergence; at least we can easily prove by experiments some conditions which cannot otherwise easily be explained.

Thus, if I bring a convex glass of 1, 2, or 3 D before my eyes and thus make myself myopic (I am emmetropic) and

[1] Compte-rendu. Copenhagen, 1884. Latent squint, especially latent divergence.

then test the equilibrium for 0.286 *m* in the method before described, I find instead of equilibrium with + 1 D, a divergence of 2°: with + 2 D a divergence of 4°; and with + 3 D a divergence of 6°. With corresponding concave lenses, I find the same degrees of convergence.

When the once adapted proportion is suddenly deranged, and simultaneous vision is abolished, the influence of the accommodation upon the convergence is satisfactorily demonstrated.

More careful examination shows, however, a regulating influence which we nevertheless must owe to the consciousness of distance.

Without any glass I accommodate for a distance of 0.286 *m;* 3.5 D, and I converge 3.5 metre-angles or somewhat more than 12°. With + 1 D I accommodate 2.5 D or for a distance of 40 *cm*, but I converge 12° — 2° = 10°, or for a distance of 35 *cm*. With + 2 D I accommodate about 1.5 D, *i.e.*, for 67 *cm*, but I converge 12° — 4° = 8°, *i.e.*, for an object at a distance of 44 *cm*. With + 3 D I need but ½ D of accommodation, and nevertheless my eye is accommodated for an object 2 *m* distant. My visual lines, however, still form a convergence angle of 12° — 6° = 6°, and consequently I am converging for an object distance of 58 *cm*.

Hence we see that the convergence does not follow the changes in accommodation, but that the eyes invariably converge for a distance less than that of the accommodation employed.

In other tests I have also discovered conditions which we must owe to the "consciousness of distance."

I believed for a long time that the stereoscope could take the place of prisms in investigations concerning convergence and divergence. Thus if we know the distance between the glasses in the stereoscope and that between the objects, we can easily discover, by means of a curve, the convergence-angle of the visual lines. But we soon found that the results obtained with the stereoscope did not agree at times with those found with prisms; with the stereoscope, I found a slighter capacity for divergence and a greater capacity for convergence than with prisms.

Univ M

It frequently happened, that patients with normal ocular muscles, with a fusion far point corresponding to a divergence of from 3° to 4° were unable in the stereoscope to arrange their visual lines parallel; the accommodation was of course abolished since the objects in this test stood at the foci of the lenses and the patient was Em. But he could not free himself from the consciousness that the object was close to the eyes, and for that reason was unable to put his accommodation completely at rest.

Just in the same way as Snellen's tables cannot be made good by the images in an optometer, just so little can stereoscopic pictures take the place of genuine objects at their natural distance in examinations of the muscular relations. In both cases the "consciousness of distance" will be led astray and thus the accommodation and the convergence will be influenced.

It is now time to take up the threads of a previous section of this paper, where we stopped at the subdivision of the static position of equilibrium into the following three groups:

1. The parallel position of equilibrium.
2. The divergent position of equilibrium.
3. The convergent position of equilibrium.

I mentioned before that under all of these conditions difficulties at near work were likely to ensue. These discomforts, which we call "muscular asthenopia," do not reveal themselves by such characteristic symptoms as in accommodative asthenopia, where the oppressive pain over the eyes and the rapid haziness of objects are constantly complained of.

Muscular asthenopia is generally characterized by a biting pain in the eyes when working at near objects as well as by lachrymation, and a feeling of weariness in the eyes which is often associated with pain radiating backward into the head and occiput. We rarely hear complaints of objects becoming indistinct, wavering, or double. And this must depend on the circumstance that the exertion to preserve the fusion produces the above-mentioned symptoms, which compel the patient to abandon his work before the muscles have totally surrendered their service.

Frequent squinting and nipping of the lids is a characteristic symptom occasionally encountered when the muscular relations are abnormal.

Since these symptoms, however, are observed not only with abnormal muscular relations, but may also, *e.g.*, be due to a blepharitis or conjunctivitis or to some nervous affection, the test with the covering hand should never be omitted.

We will now more closely investigate the especial forms and begin with the first group.

First Group.—Parallel position of equilibrium for distance.

To this group belong, first, all cases with normal muscular relations, where we find a fusion far point corresponding to a prism of 8° with base inward, the fusion near point about 6 *cm*, and equilibrium for the three distances.

To this group belong also cases in which we have a normal fusion far point, and parallel position for equilibrium, but *divergence for near*. Even at 1.15 *m* the patient asserts that the upper ruler stands somewhat to the right (prism with base downward for the left eye) corresponding to a divergence of 1° to 2°, and a still greater divergence, 2°—8°, will be noticed for the distance of 0.286 *m*. Under these circumstances, then, the equilibrium near point must be pushed farther away, as far as 2–3 *m*, or even to the equilibrium far point, so that often the amplitude of equilibrium is lost or is but very slight in extent.

If the conditions of equilibrium are such as these, the fusion near point must be pushed farther outward but to a proportionally less degree; we generally find it from 9 to 20 *cm* distant, rarely farther. Such a removal of the equilibrium near point and of the fusion near point can only be due to defective converging capacity, and upon what this latter depends we do not yet precisely know.

We have already mentioned the relation of accommodation to convergence, and that this is important is clear enough. The co-operation of accommodation and convergence is the reason why every exertion of accomodation involuntarily produces an inclination to convergence, and *vice versa*. In

myopia, particularly when of high degree, the convergence is forced to dispense with some support, but this may be of no account since we have already seen, in the examples of normal muscular relations, that even a myopia of 6 D has not caused any disturbance of convergence.

It is my opinion that a developing myopia will only obtain an importance for the muscular relations, when the convergence is more or less defective from the start; under such circumstances the myopia might bring out defective capacity for convergence. In judging the importance of myopia, we must also consider how much more frequently it occurs in proportion to emmetropia and hypermetropia in those persons who use their sight a great deal for near objects.

A unilateral amblyopia will be of similar importance for the convergence, especially with an extreme variation between the sight of the eyes. In such a case, the fusion will be easily dissolved, and a defective convergence so much the easier come to light. The real cause will have to be sought, either in the muscles themselves, or in the condition of the innervation. The term, insufficiency of the interni, as we call this condition, shows that defective capacity for convergence has been chiefly regarded as a sequence of diminished muscular energy.

The interni work in two ways, partly with the externi in the associated movements of the eyes, partly alone, in preserving the convergence. With insufficiency we find no limitation of the movements of the eyes in lateral rotation, whilst a considerable defect of convergence may exist. If the lateral movements of the eyes demanded as much muscular energy as is demanded in the movements of convergence, we should be obliged to conclude that the defective convergence could not depend upon a weakness of the muscles, which perform the whole work in the associated movements; the insufficiency must, in this case, originate from anomalous innervation.

Nevertheless, we are scarcely justified in identifying the muscular work produced by two different motions.

We have found for normal eyes that the fusion near point lies at about 6 *cm* from the rotation point of the eyes. The angle of convergence between the visual lines will then be

about 60°, therefore the rotation of each eye will amount to about 30°. According to Alfred Graefe,[1] the eyes in associated lateral motions can accomplish a version of from 42° to 45°.

We find, therefore, that the interni, when normal and working in the service of convergence, accomplish only about $\frac{2}{3}$ of the motion which they are able to give to the eyes when they act associatedly with the externi, and yet (if we grant to the sensations which we perceive in carrying out this experiment, any importance at all), we feel distinctly that the interni are stretched and exerted differently when we converge, than when we use them in associated lateral movements. This signifies that the convergence makes greater demands upon the interni than do associated lateral motions, and it may suffice for an explanation to say that the lateral motions can still be accomplished with ease, whilst the convergence is still defective. We must also reflect that the eyes are only held for brief intervals in the extreme lateral positions, whilst the convergent position is the most customary.

The term "insufficiency of the interni" was not a happy one, because we cannot positively affirm that the muscles are actually at fault, and because the name has not only been employed in the condition of things with which we are now occupied (a parallel position of equilibrium for distance with defective convergence), but also in the cases which belong to the next group, divergent position of equilibrium for distance.

The most correct term would be "*convergence insufficiency*," which adequately expresses the condition of affairs without making any attempt at an explanation of the cause.

The following case is a remarkable example of convergence insufficiency:

Student, æt. 22. 90° — 0.75 — 1.5; 80° — 0.75 — 1.5
$\frac{10}{10}$ *p. p.* 10 *cm* $\frac{10}{10}$.

3.45 *m.* Conv. > 0.
1.15 " Div. 4 *cm* = 2° } Without lens.
0.286 " " 3.5 " = 7° }
1.5 " => 3° with —2; — 2.

[1] *Graef-Saemisch*, Bd. vi., p. 11.

Fusion far-point prism 8°.

Fusion near point about 20 *cm;* the patient cannot state positively that he has got rid of the perception of double images ; but one eye invariably deviates outward when a point of light or a book is brought up to a point about 20 *cm* away.

He complains of burning and weariness in the eyes after reading a short time ; also of tension in the eyes, which he is all the time blinking and winking. He has used a lorgnette of 2 D concave for reading and can then use his eyes considerably longer.

Even when he converges to the maximum extent, the eye does not turn in any more than so as to leave a distance of about 2 *mm* between the inner corneal margin and the punctum lachrymale. In associated movements, however, the inner corneal margin turns way over to the caruncle.

Our patient has a positive range of fusion, or range of convergence of scarcely 5 metre-angles. There is scarcely any range of equilibrium, but there must be a point of equilibrium at a distance of about 3 meters.

The myopia is rather slight, but surely not without importance, not, however, as a cause, but because, as formerly mentioned, the convergence is thereby partly deprived of a support of which, in the preceding case, it stands so much in need.

The determination of the fusion near point in this case could only be carried out approximately, because the patient had got out of the habit of seeing crossed double images. As we witness this very rarely in pure convergence insufficiency, we shall describe it more in detail in the next section. It is peculiar that these individuals cannot abandon fusion, and that they let one eye follow its longing to deviate, when they cannot possibly grasp the crossed double images that arise during divergence. Long-continued practice is the only thing that can bring about this desired condition and the outcome of it all in the majority of cases is a manifest deviation for objects near at hand.

It is quite natural that in a case so well pronounced as this, asthenopia should appear, but the point of the greatest interest for us to discover is how great the deviation in the equilibrium experiments can be, and how far the fusion near point can move away before the asthenopia begins.

Without speaking decidedly, I think that I have discovered that when the divergence for the distance of 0.286 *m* is less than 3°, and when the fusion near point is less than 10 *cm*, asthenopia will scarcely be felt in pure convergence insufficiency.

We must bear in mind these two points: the less the fusion near point is removed, the better the deviation from equilibrium can be tolerated.

The dislocations of these points often stand in a suitable relation to one another, as we see from the following case:

7) Miss H. V. " " " ; " " "

	< $\frac{1}{10}$	< $\frac{1}{10}$
5.75 *m*	. . . . .	o
1.15 "	. . . . .	Div. 3 *cm* = 1.5°
0.286 "	. . . . .	" 3.5 " = 7°

Fusion far point, prism 7°. Fusion near point, 20 *cm*.

8) Miss K. " " " ; " " "

	< $\frac{1}{10}$	< $\frac{1}{10}$
3.45 *m*	. . . . .	Div. 2 *cm* = 0.3°
1.15 "	. . . . .	" 4 " = 2°
0.286 "	. . . . .	" 1.5 " = 3°

Fusion far point, prism 8°. Fusion near point, 11 *cm*.

I believe, however, that the equilibrium deviation for 0.286 *m* is often proportionally greater than the removal of the fusion near point, and particularly in myopes, that we can find distinct divergence in the equilibrium tests united with an almost normal fusion near point.

9) Mr. A. 50° + 1.25 − 0.5 ; " " "

5.75 *m*	. . . . . Div. 4 *cm* = 0.4°
1.15 "	. . . . . " 4 " = 2°
0.286 "	. . . . . " 3.5 " = 7°

Fusion far point, prism 9°; near point, 11½ *cm*.

(He closes the left eye after reading a while, and especially by artificial light.)

10) Miss M. æt. 14 " " − 5 ; " " " − 6

3.45 *m*	. . . . . o *cm* with − 4 ; − 5
1.15 "	. . . . . Div. o " " − 3 ; − 4
0.286 "	. . . . . " 0.5 " " − 3 ; − 4
	. . . . . "0.25 " = 5° without lens.

Fusion far point, prism 6°; near point, 7 *cm*.

It may be advantageous to distinguish between these two groups—between those with a fusion near point, removed to a considerable distance and those in which this point is but slightly removed. The latter still have a large amplitude of fusion at their command, and they can be more easily assisted than the former, whose amplitude of fusion is noticeably diminished.

Landolt [1] has asserted that one must have an overplus of at least $\frac{2}{3}$ of his range of fusion in order to work for any length of time. When the work is held at 33 *cm*, the patient uses a convergence of 3 metre-angles; in order to endure this work, the patient must have at command a convergence of over 3 metre-angles. The entire positive amplitude of fusion would amount to 9 metre-angles, and the fusion near point lie at a distance of 11 *cm*.

Landolt grants, however, that he has often found that a still greater reserve fund is needed, even as high as $\frac{3}{4}$ of the amplitude of convergence, and as I have discovered, that the fusion near point ought not to lie farther off than 10 *cm*, we probably need more than $\frac{2}{3}$ of the amplitude of convergence as a reserve fund, but for the sake of brevity we can use this fraction in the calculation.

If we have a patient with a fusion near point of 14 *cm*, and consequently with a positive amplitude of fusion of 7 metre-angles, he will at a working distance of 33 *cm* have 2 metre-angles too little. Fortunately it will not be the question of compensating for these metre-angles, but only $\frac{1}{3}$ of them. The affair is this: that of the 7 metre-angles of convergence amplitude needed during work he must use only $\frac{1}{3}$ (or really somewhat less) or $2\frac{1}{3}$ metre-angles. In other words he must converge at the most for an object-distance of 43 *cm*, unless asthenopia shall arise.

But if his working distance for one or another reason must be precisely 33 *cm*, it will be our task to help him for this distance, without his being obliged to converge up to more than 43 *cm*, and this we can accomplish by means of prisms. The difference in the convergence between 43 *cm* and 33 *cm* expressed in metre-angles amounts to $\frac{2}{3}$ of a metre-angle

[1] Bericht ueber die XVII. Vers. d. ophth. Gess. zu Heidelberg, 1885.

($\frac{1}{3}$ of the lacking 2 metre-angles) = 2.20°. Prisms 2¹° base inward for each eye would then enable him to work between the customary working distance and the convergence.

Practically the affair is not so easy as here described. Prisms are the most difficult things to order, because we can

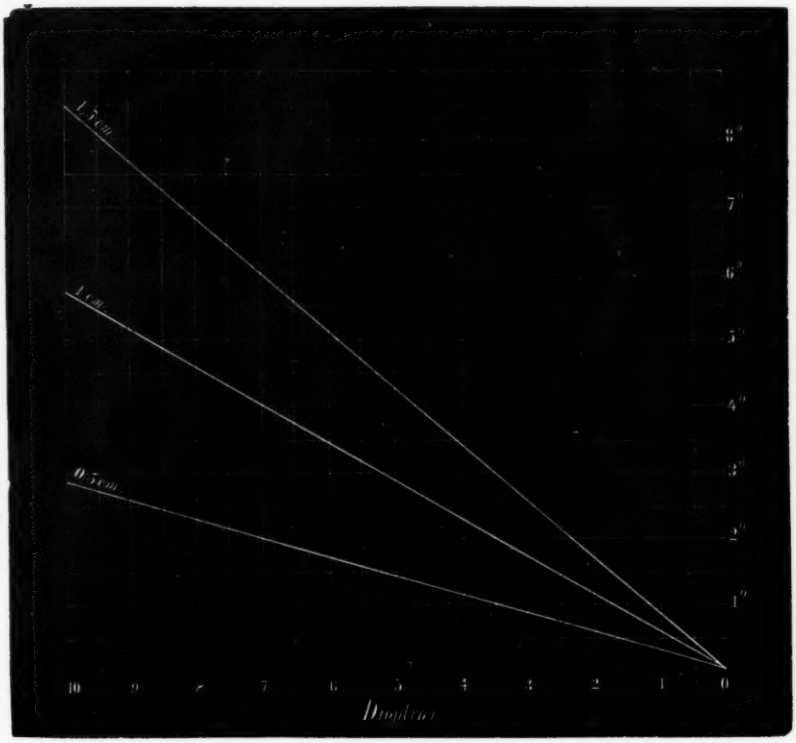

FIG. 7.

never predict what effect they will have. Many people cannot endure them, to others they are of the greatest assistance. If prisms seem indicated, I always tell the patient that they are chiefly experimental, and may be of no use to him.

We should never begin with prisms stronger than 2° or 2½° for each eye; if necessary strengthen them later. Stronger than 4° for each eye can rarely be endured.

When we are obliged to use spherical lenses for presbyopia or refractive disabilities, we know that the use of concave lenses will oppose convergence insufficiency, so that it may often suffice to give the patient more or less correcting concave lenses for his work.

When convex lenses have to be worn (thus sparing the accommodation), the convergence is robbed of a good support. It may nevertheless occur, that when we remove the accommodative asthenopia by means of the convex lenses, the convergence asthenopia will be increased. Hence we must often attempt a combination of spherical lenses with prisms. And yet with stronger spherical lenses we can accomplish this effect by making the distance between the centres of the lenses different from that between the pupils.

The effect of decentring lenses can be seen from Fig. 7, where the three lines represent the prismatic action of spherical lenses in degrees (not prismatic degrees) with a difference of 0.05, 1, and 1.50 *cm* between the centres of the lenses and the pupillary distance. With + or — 2 D we can obtain an effect of 1° 9′ when the distance between the centres of the lenses is 1 *cm* greater or less than the pupillary distance. The effect will correspond to a prism of a little more than 1° for each eye.

We can scarcely utilize a difference of more than 1½ *cm*, and then there is nothing more to do than to produce this difference by shortening or elongating the nose-piece of the spectacles. In case of a greater difference than 8 *cm* we can produce the surplus by grinding the lenses eccentrically into the frames.

Second Group.—Divergent position of equilibrium for distance, latent divergent strabismus.

Here we find a fusion far point, corresponding to prism of 10° to 20°, according to the degree of the divergence. The fusion near point is pushed away, and yet in *young* persons we occasionally find a normal near point despite marked divergence.

The equilibrium test shows the upper ruler (prism base down for left eye) pushed more or less to the right at all distances. If we assume that in a given case at the distance of 5.75 *m*, the movement amounts to 50 *cm* (5 °), it would then be expected that the same degree of divergence would also be observed for shorter distances, but I have never found any such condition of things. Generally we find an increasing divergence for shorter distances, *i. e.*, *the latent divergence is generally accompanied with convergence insufficiency.*

11*a*) Student, aged 27, 90 ° — 0.5 — 2.5 ; 80 ° — 1 — 2

		$\frac{20}{36}$			$\frac{20}{36}$
3.45 *m*	Div.	36	*cm*	=	6 °
1.15 "	"	16	"	=	8 °
0.286 "	"	6	"	=	12 °

Fusion far point, prism 12 ° ; near point, 7 *cm.*

11*b*) Mrs. N., aged 52, " " + 3.5 ; " " + 4.5

3.45 *m*	Div.	40 *cm*	= < 7°	With + 3.5 ; + 4.5
1.15 "	"	16 "	= 8°	
0.286 "	"	5 "	= 10°	

Fusion far point, prism 18 ° ; fusion near point, 10 *cm* (barely ; the eye generally deviates before reaching this distance).

There is no range of equilibrium in latent strabismus divergens, but simply a point of equilibrium which is negative, and rather near the fusion far point, and, as in the first case, often coincides with it.

When the muscles are normal, we have a range of convergence extending from infinity to the fusion near point, and an amplitude of divergence from infinity to the fusion far point. Infinity is the limit between these two ranges, because the static position of equilibrium is parallelism between the visual lines. Where the static position of equilibrium is divergent, the point of equilibrium forms the boundary between the range of convergence and divergence. Hence the range of convergence in those belonging to this group will be mostly extended beyond infinity to the fusion far point, whilst the range of divergence will be extremely slight if any. Therefore, the range of convergence will form almost the whole of the range of fusion, and where we find a

normal fusion near point the amplitude of convergence will be largely increased. This seems to occur chiefly in younger persons, and suggests that the interni in latent strabismus divergens are better developed than usual, and must be very powerful, since for years, nay, often for life, they perform the majority of the work demanded of them under these conditions of equilibrium.

We find, however, still more frequently that the interni—earlier or later, depending entirely upon the degree of the divergence, the strength of the muscles, and particularly the alterations in the refraction of the eyes—can no longer perform their work; defective convergence ensues at once. This then gradually leads to the deviation of an eye, first at the ordinary distance for work, later in looking off at a distance, at all events in the higher degrees of the affection; then we may find a periodic squint, either only for near or often enough for all sorts of distances, and in this case the natural termination can be a manifest divergent strabismus.

When defective convergence begins, asthenopia must ensue; but when things have gone so far that one eye constantly deviates, and that squint is actually present for the ordinary distance at which the work is held, the former weariness disappears, and the patient no longer complains of diplopia. Double images may at first be seen, but they soon disappear.

The result of all this is, that here we have a peculiar condition, which arises from the difficult conditions of convergence. The patient gradually learns of his own accord to overlook the image of the deviating eye which falls upon the out-turned half of the retina. Such an individual cannot see crossed double images under ordinary circumstances, and the fusion will then be more and more dissolved.

We have the right to conclude that this condition is acquired, and not congenital, owing to the facts that the patient may have passed through a stage in which he actually saw double; that he can once more learn how to perceive the crossed double images; and finally, that when the retinal image is brought by prisms upon the inner portion, it is instantaneously embraced, as is proved by the

homonymous double images. In this person, therefore, we shall easily be able to fix the situation of the fusion far point, whilst the fusion near point can only approximately be discovered because we have to watch closely to see when the eye deviates; it will therefore be best to employ a larger object, as a lead-pencil, for this part of the test.

When the refraction and the vision are about the same in the two eyes, now one eye will deviate and now the other, and in this case it will be impossible for the patient to see crossed double images; but when the condition of things is such as invariably to cause one and the same eye to deviate, we shall generally be able to bring out the double images, when we can induce the patient to fix with this eye, and to let the better eye deviate. Having never had an opportunity in the better eye of learning how not to see the images upon the outer halves of the retina, he will at once grasp them, and diplopia will arise.

I have sometimes noticed in cases of extreme latent divergence that the patient could not see double during the test for equilibrium, particularly at greater distances, in spite of the fact that the variation in the height of the objects was produced by a prism with the base down before the left eye, whereby the image in this eye was made to lie in a portion of the retina which otherwise was not simultaneously affected with the macula lutea of the other eye. In such a case it may happen that we can establish nothing but the fusion far point.

There was one patient whose fusion far point corresponded to a prism of 30°, in whom, however, the second image appeared, after so strong prisms with the base inward had been brought in front of the other eye that the double image lay at the same level with the macula. With prism 25° he saw two rulers at 3.45 *m*. At 0.286 *m*, however, he caught the double images without any difficulty; here was a divergence of 11 *cm* = 22°. He had myopia, 5.5 D, and read with — 4.5 D.

Finally, we meet with cases in which during the equilibrium test only a slight divergence is observed or none at all, or there is an actual convergence, although the eye diverges noticeably underneath the covering hand.

All this goes to show that the equilibrium test sometimes gives no results at all, and in others an incorrect result, but still I do not believe that we are justified in rejecting the test entirely, as some have proposed. For in most of the cases it is perfectly reliable, and under all circumstances we verify the result by other investigations.

Here are examples of the rarer forms.

12) Miss D., æt. 40. $\frac{'\ '}{\frac{20}{40}} - 7$; $178° - 1.5 - 6. < \frac{20}{40}$

She complains of burning in the eyes, and weariness on reading; extreme deviation under the covering hand; fusion far point prism 24°; fusion near point cannot be determined, because she cannot see crossed double images.

During the equilibrium-test she can with difficulty see two rulers, but when she sees them for an instant as two, she exhibits not a little convergence.

13) Miss B., æt. 23. $\frac{'\ '}{\frac{20}{40}} - 1$; $\frac{'\ '\ '\ '}{\frac{20}{40}}$

Similar complaints as the above patient; extreme deviation under the covering hand. Fusion far point 22°, fusion near point 7 *cm.*

Equilibrium test shows the rulers above one another, with slight convergence; when one eye is covered it deviates greatly, but flies back again when the covering hand is removed. While divergent, the double images could not be perceived.

Latent divergent strabismus is seen at all ages, even in children, but it is rare for children to be brought to the oculist for this defect alone. Generally, the patients are from fifteen to thirty years of age, complaining of asthenopia or imagining that one eye deviates.

Can we think that this condition depends upon the fact that the static muscular relations really alter with the age? I think that they are congenital and never change but slightly. We can explain the rarity of divergence in children partly by the fact that their refraction is generally hypermetropic, and partly because the interni at that age are still powerful and have not yet been overburdened by the persistent and

extreme amount of convergence demanded at school at their age.

It often happens that several children in the same family suffer from latent divergence, and so too we not infrequently see that when one of the parents suffers from latent divergent strabismus one or more of the children suffer with the same affection. This proves that the condition may be hereditary; and this again suggests that it is congenital.

14) Mrs. B., æt. 28. $\frac{'}{'} - 5$; $\frac{'}{'} - 5$.

Accustomed to close the left eye whilst reading; otherwise no trouble at close work; extreme divergence under the covering hand; fusion far point, prism 28°.

The fusion near point cannot be determined because she cannot perceive any crossed double images; she can converge with a lead-pencil up to about 20 *cm*; she also fails to see double images with the equilibrium tests.

She has always regarded the closing of her left eye in reading as a bad habit, which she thinks she inherited from her father, who always closed his left eye in reading.

We know, however, that closing one eye for near work is something that a few with abnormal muscles have had the good luck to learn how to do, and because the father also had this "bad habit" we can conclude that he had latent divergence.

This mother came with her son of five years, because after looking long at any thing there seemed a momentary squint, and I soon discovered that under the covering hand the eye actually diverged a great deal. He was, however, too young to test his equilibrium.

Latent divergent strabismus is observed in all conditions of refraction, but we find it most often combined with myopia and emmetropia. Hypermetropia is a rarer refractive condition in adults, and an hypermetrope will not be troubled so soon with a moderate degree of divergence.

In the *treatment* of latent divergent strabismus we have three points to bear in mind. In the first place *any difference* in refraction must be compensated for, and by accurate correction of any astigmatism, we must endeavor to make both eyes see alike in order to increase as much as possible the need for fusion.

The fusion will generally be more or less "dissolved," and therefore we must in the second place endeavor to strengthen it. For this purpose we may most advantageously resort to stereoscopic practice with decreasing distance (Javal). In using this the need for fusion will not only be awakened and increased, but the interni will be strengthened, and we have a right to think that these exercises may act as a sort of gymnastic upon the muscles. It is a fact, that the asthenopia in a few cases can only be alleviated to any great extent by stereoscopic exercises.

Thirdly, we have to direct our treatment directly against the divergence; this we do indirectly by prescribing concavo-prismatic lenses, or directly by tenotomy of the rectus externus.

If myopia is present there may be no need of any thing else than correcting lenses. The accommodation will then begin to play its part, and the support which the interni then obtain will, in many cases of moderate divergence, excite and maintain the necessary convergence. If concave lenses do not alone suffice, we can increase their effect by a combination with prisms. With Em, Pr and Hm, we can only oppose the divergence by prisms, which are to be used alone or combined with convex lenses.

15) Mr. P., æt. 38. $\overset{\prime\ \prime\ \prime}{> \frac{10}{10}}$; $\overset{\prime\ \prime\ \prime}{> \frac{10}{10}}$

He complains of burning in the eyes, and is constantly compelled to nip his eyelids in order to see clearly; the eyes deviate largely under the covering hand.

3.45	*m*	Div. 16	*cm*	=	$< 3^\circ$
1.15	"	" 4.5	"	=	2.25°
0.286	"	" 3.75	"	=	7.50°

Fusion far point, prism 10°; fusion near point, scarcely 15 *cm.*

He was ordered for work Pr. $3^\circ + 1$; Pr. $3^\circ + 1$ base in; for out-of-doors Pr. 2°; Pr. 2° base in.

I rarely order prisms for a distance with so slight a degree of divergence as here, but, they were so agreeable, that he liked to use them; they made "objects look so firm and

steady." He could work for a long time with the combination ordered for close work.

We must tenotomize the external rectus in the higher degrees of divergence, but we ought to know how great the effect of this tenotomy will be before we can decide whether it is the best thing to do in the given case.

V. Graefe gave very accurate rules for tenotomy in insufficiency, but I think that they are too complicated, and therefore I will report a few cases in order to show the amount of effect that I have discovered in my investigations.

16) Miss M., æt. 18 $\frac{\text{″ ″}}{\frac{20}{30}}$; $\frac{\text{″ ″ ″}}{\frac{20}{20}}$

3.45 *m*	Div. 80 *cm*	= 13°
1.15 "	" 32 "	= 16°
0.28 "	" 7 "	= 14°

Fusion far point, prism 26°; near point, 7 *cm*.

Oct. 31: Tenotomy R ext. rectus. Nov. 1: 3.45 *m* — 0. This condition remained the same, *i.e.*, parallel equilibrium position for far.

Effect of tenotomy = 13° (Pr. 26°).

17) A. O., æt. 12. $\frac{\text{″ ″}}{\frac{20}{30}} + 2$; $\frac{\text{″ ″ ″}}{\frac{20}{30}}$

Left eye deviates when reading; no asthenopia.

3.45 *m*	Div. 120 *cm*	= 20°
1.15 "	" 44 "	= 22°
0.286 "	" 4 "	= 8°

Fusion far point Pr. 40°; near point, 28 — 30.

Tenotomy L ext. rectus; directly after at 3.45 *m*; Div. 24 *cm* = 4°

Next day: 3.45 *m*	Div. 48 *cm*	= 8°
1.15 "	" 16 "	= 8°
0.286 "	" 1 "	= 2°

Fusion far point, Pr. 16°; near point 8 *cm*; effect of the tenotomy = 12° (prism 24°).

This is the first case in which I found divergence less for 0.286 *m* than at a greater distance; it is remarkable that this condition remained after the operation.

18) Hanna O., æt. 10. $\frac{\text{″ ″ ″}}{\frac{20}{30}}$; $\frac{\text{″ ″ ″}}{\frac{20}{20}}$

5.75	*m*	. . . . .	Div. 84	*cm*	= 8.4°
1.15	"	. . . . .	" 19	"	= 9.5°
0.286	"	. . . . .	" 5.5	"	= 11°

Fusion far point, Pr. 16°; near point, 5 *cm.*

Despite the normal fusion near point she had considerable trouble on account of the divergence.

Tenotomy of left external rectus :

Next day :	5.75	*m*	Conv. 52	*cm*	=	5.2°
	1.15	"	" 7	"	=	3.5°
	0.285	"	" 0.75	"	=	1.5°
Later :	5.75	"	" 52	"	=	5.2°
	1.15	"	" 10	"	=	5°

The conjunctival incision had as usual been closed with a vertical suture : this was removed and a broad horizontal suture inserted, and introduced so deeply from without that the muscle was grasped—and then we found :

	5.75	*m*	Conv. 5	*cm*	=	0.5°
Two days later :	5.75	"	Div. 16	"	=	1.6°
	1.15	"	" 4	"	=	2°
	0.286	"	" 1	"	=	2°
Two months later :	5.75	"	" 4	"	=	0.4°
	1.15	"	" 0			
	0.285	"	" 0			

Fusion far point, Pr. 8° ; near point, 4 *cm.*

No difficulty in reading : effect of the tenotomy 13.5° (Pr. 27°).

19) Miss N., æt. 20. $5^\circ - 2 - 11$; $5^\circ - 2.5 - 6$.
$\frac{20}{16}$ $\frac{20}{40}$

Reads with RE : left at first held correctly but it soon deviates.

With lenses $5^\circ - 2 - 10$; $5^\circ - 2 - 4$: we found at

3.45	*m*	. . . . .	Div. 30	*cm*	= 5°
1.15	"	. . . . .	" 24	"	= 12°

With lenses $5^\circ - 2 - 9$; $5^\circ - 2$ 3.5, for 0. 286 *m* : Div. 4.5 *cm* = 9°.

Fusion far point, Pr. 24° ; near point, 55 *cm.*

The test for 1.15 *m* shows that the divergence for far must be greater than is given—to judge from the fusion far point, about 12°.

February 26.—Tenotomy of left ext. rect., after which :

3.45 *m* . . . . . Conv. 16 *cm* = 2.5°
1.15 " . . . . . " 4 " = 2°
0.286 " . . . . . Div. 1 " = 2°

She complains of constant homonymous diplopia.

3.45 *m* . . . . . Conv. 32 = 75°
1.15 " . . . . . " 12 = 6°

A deep horizontal suture removed the convergence.

February 28.—

3.45 *m* . . . . . Conv. 16 *cm* = 2.5°
1.15 " . . . . . " 0 "

Glasses for out-of-doors : 5° — 2 — 7 ; 5° — 2.5 — 3.5.

March 25.—With the lenses.

At 3.45 *m*, 1.15 *m*, and 0.286 *m* no divergence—effect of the tenotomy 17° (Prism 34°).

20) Johanna, æt., 36 $\frac{20}{20}$ " " " ; $\frac{20}{30}$ " " "

Always inclined to see double : asthenopia well marked of late by artificial illumination.

5.75 *m* . . . . . Div. 76 *cm* = 7.6°
1.15 " . . . . . " 14 " = 7°
0.286 " . . . . . " 6 " = 12°

Fusion far point Pr. 15° ; near point, 25 *cm*.

November 19.—Tenotomy L ext. rect., immediately afterward at :

5.75 *m* . . . . . Div. 6 *cm* = 0.6°
1.15 " . . . . . " 3 " = 1.5°
0.286 " . . . . . " 2 " = 4°

November 28.—

5.75 *m* . . . . . Div. 16 *cm* = 1.6°
1.15 " . . . . . " 6 " = 3°
0.286 " . . . . . " 1.75 " = 3.5°

Fusion far point Pr. 7° : near point 8 *cm*, no asthenopia.

She reported again in a few months an account of asthenopia by gaslight.

5·75 *m* . . . . . Div. 44 *cm* = 4·4°
1.15 " . . . . . " 11 " = 5·5°
0.286 " . . . . . " 3·5 " = 7°

Fusion far point, Pr. 9°: fusion near point, 13 *cm*. Lenses ordered Pr. 2°; Pr. 2°: base in: effect directly after tenotomy = 7° (Prism 14°): reduced later to 3° (Prism 6°).

The result in these five cases was therefore:

In No. 16 = 13° (Prism 26°)
17 = 12° (" 24°)
18 = 13.5° (" 27°)
19 = 17° (" 34°)
20 = 7° (" 14°): finally only 3° (Prism 6°).

The effect in 18) and 19) would probably have decreased, but as the convergence was greater than desirable, I thought it most advisable to reduce the effect by the horizontal suture. Nevertheless, we see that with a fusion far point corresponding to prism of 26° to 28°, we can calmly tenotomize the rectus externus without fearing too extensive a result. With a fusion far point less than 26° and down to 16° there is no need of convergence after the operation, but we must be ready to limit the effect by a deep horizontal suture—*i.e.*, we must perform a slight advancement operation, and particularly in children. The older the patient, the more fearlessly we can tenotomize in the lower degrees of divergence, even when the fusion far point is less than a prism of 16°.

If convergence follows the operation it may be difficult to decide, whether we shall act at once or wait, because the over-effect begins to decrease within a few weeks; still on the day after the operation I should not like to permit a convergence greater than a few degrees.

There are, however, a few cases in which we cannot do much if any thing for our patients. This is especially possible when the divergence is too small for a tenotomy to be permissible, but still too great to obtain any correction by prisms, owing to a high degree of convergence-insufficiency.

In such cases I advise the patient to close one eye, or to cover it, as a few patients had already done of their own accord; but this has seldom had the desired effect.

First Group.—Convergent position of equilibrium for distance or latent convergent strabismus.

Here we find the fusion far point pushed in corresponding to a fusion of 6° down to 0°, and the fusion near point nearer, or even normal or pushed outward, since latent convergent strabismus may be combined with a convergent insufficiency.

The equilibrium tests generally show convergence for all distances, usually decreasing somewhat at 1.15 and 0.286 *m*, but even at this distance there may be a greater convergence than at 3.45 *m*. Near the fusion near point, however, we come to a spot where equilibrium reigns, and within this distance divergence comes on.

In latent convergence, too, there is no range of equilibrium, but only a point of equilibrium, and this lies more or less in the neighborhood of the fusion near point.

21) H. D., æt. 11 ″ ″ ″ + 1 ; ″ ″ + 1

5.75 *m* . . . . . Conv. 32 *cm* = 3.2°
1.15 " . . . . . " 6 " = 3°
0.286 " . . . . . " 1 " = 2°

Equilibrium at 20 *cm*; fusion far point, Pr. 5°; fusion near point, 6 *cm*.

22) M., æt. 25 ″ ″ − 1 ; ″ ″ − 1.5
$\frac{20}{10}$ $\frac{20}{10}$

5.75 *m* . . . . . Conv. 16 *cm* = 1.6°
1.15 " . . . . . " 3.5 " = 1.75°
0.286 " . . . . . " 0.5 " = 1°

Equilibrium 40 *cm*; fusion far point, Pr. 3°; fusion near point, 6 *cm*.

23) Miss S., æt. 19 ″ ″ − 2.5 ; ″ ″ − 2.5
$\frac{20}{10}$ $\frac{20}{10}$

3.45 *m* . . . Conv. 56 *cm* = 79° with − 1.5 ; − 1.5
1.15 " . . . " 20 " = 10° without lens
0.286 " . . . " 3 to 6 " = 6° to 12° without lens

Equilibrium at 12 *cm*; fusion far point = ∞ ; fusion near point = 10 *cm*.

Since the point of equilibrium lies close to the fusion near point, and forms the boundary between the range of con- and di-vergence, the range of convergence in this condition must be extensively reduced and that of divergence enlarged. The externi will have to do a greater share of the work, and therefore they must be very strong in order to maintain the standard demanded of them.

Just as we discovered in the previous group that convergence became defective when the interni weakened, so here, when the externi give way, defective divergence must ensue, and the fusion far point must be pushed inward. When it already lies inside of infinity, or falls within infinity on account of the defective externi, we have a manifest convergent strabismus for far, which must increase the more the externi lose in energy. We often hear of squint when the fusion far point lies precisely at the limit of infinity, or when squint has already been present, that it increases whenever the patient does not feel well or has a headache, due of course to the fact that one cannot work when unwell as when feeling well, and this is as true of the ocular muscles as of those of the rest of the body.

We ought in cases of manifest convergence for far, to expect homonymous double images, and as a matter of fact we do hear of them, but we see that here too the same state of things is developed as we have mentioned in divergence. The patient learns to overlook the image of the deviating eye, and as the eye glides inward, the images of the inturning retina are suppressed. For this reason in manifest convergence for far or where this condition is developing, it is often difficult or impossible to fix the fusion far point.

If the images pass over the outer halves of the retina they will at once be grasped; crossed double images appear, and the fusion near point can always be determined.

For these reasons we find a complete analogy between the conditions for the fusion near point in divergence and the fusion far point in convergence.

24) Miss J., æt. 19 $\overset{\prime\prime\prime}{<\frac{20}{20}}$; $\overset{\prime\prime\prime}{<\frac{20}{20}}$

Scarcely visible manifest convergent strabismus for far.

3.45 *m* . . . . . Conv. 50 *cm* = > 8°
1.15 " . . . . . " 13 " = 6.5°
0.286 " . . . . . " 2.5 " = 5°

Equilibrium at 16 *cm* :

The fusion far point cannot be determined because the patient cannot grasp the homonymous images. Fusion near point, 12 *cm.*

25) Mrs. K., æt. 51. $0° - 0.5° - 5$; $0° - 1 - 5$
$< \frac{10}{10}$ $< \frac{20}{20}$

The right eye turns a great deal in : patient thinks it did not do so till a few years ago, and that it has lately grown much more marked.

3.45 *m.* Separation of double images too great to be measured at this distance.

1.15 *m* . . . . . Conv. 64 *cm* = 32°
0.286 " . . . . . " 8 " = 16°

Unfortunately the equilibrium point was not then fixed : it probably lay at 8 to 10 *cm.* The fusion far point cannot be determined as patient cannot see homonymous double images. Fusion near point was not measured : *binocular reading at* 20 *cm !*

The convergence that appeared and even increased at such an advanced age can only be explained by taking it for granted, that the fusion far point had been pushed inward owing to the lack of tone in the externi which were forced to undertake a task beyond their power.

Where the vision of the eyes varies and the same eye always deviates, we can occasionally cause the patient (even with manifest convergence for far) to see double images, particularly when we can induce him to fix with the eye that generally deviates.

26) Ottilie, æt. 14. Periodic squint many years. Thinks as a child she could read without squinting ; now the right eye deviates inward whilst reading.. For distance she arranges her eyes in two ways : one when she wants to see clearly, in convergence ; but when she wants to be " beautiful " she is satisfied with less acute vision and her eyes are straight. In the latter case,

S = $\frac{10}{10}$, but when she squints and looks with one eye alone (the left) S < $\frac{10}{15}$.

$$\text{" " "} \frac{10}{15} + 1 \; ; \; \text{" " "} \frac{10}{15} + 1$$

With correcting lenses she sees equally well, whether she squints or not.

She always looks with the left eye, and never had double images; but when she fixes with the right eye, which she easily learned, and the left eye deviates, homonymous images at once appear, because the image falls on the inner half of the retina of the left eye, and these images, from lack of a chance to overlook, she has not yet been able to get rid of.

3.45 *m*—when she squints—conv. 80–90 *cm* = 13°
1.15 " . . . . . " 12–32 " = 6°–16°
0.286 " . . . . . " 9 " = 18°

Equilibrium point at about 8 *cm*: fusion far point (fixation with right eye), Pr. 8°, base in. Fusion near point, 8 *cm*. With + 4; + 4 she reads without squinting, and for 0.286 *m* has converg. 1 to 2 *cm* = 2° to 4°.

The two following cases are interesting on account of the high degree of myopia:

27) Dr. K.. age 55. " " $\frac{10}{10}$ − 14 ; " " $\frac{10}{40}$ − 11

3.45 *m* . . . . . Conv. 64 *cm* = 10½°
1.15 " . . . . . " 8 to 20 " = 4° to 10°
0.286 " . . . . . " 0.5 " = 1°

Equilibrium point at 20 *cm*; fusion far point ∞; fusion near point, 7 *cm*. In the equilibrium test he can only with difficulty maintain the double images; that of the left eye disappears easily; he asserts that he could voluntarily suppress it.

28) Frederick K., æt. 19. " " $\frac{20}{100}$ − 14 ; " " $\frac{20}{100}$ − 14

No squint, but under the hand the eyes deviate excessively inward.

1.15 *m* convergence about 40 *cm* = 20°.

He reads binocular at about 12 *cm*, and at this distance there is apparent equilibrium.

Latent convergent squint occurs in all conditions of refraction. Most of the cases are, however, myopic, and the myopia probably explains why most of the cases are latent. With Em or Hm a *manifest* strabismus would in all probability long since have developed.

The significance of Hm can be seen from this case:

29) Mr. H., æt. 27. " " + 4 ; " " + 3
$< \frac{20}{40}$ $< \frac{20}{30}$

	without lens:	with + 4 ; + 3
3.45 *m* . .	Conv. 32 *cm* = >5°	Conv. 8 *cm* = >1°
1.15 " . .	" 20 " = 10°	" 2 " = 1°
0.286 " . .	" 4–5 " = 8°–10°	Div. >0

Equilibrium not tested. } Probably about 30 *cm.*
Fusion far point, Pr. 16°, base *out.* } Pr. 3°, base *in.*
Fusion near point, 18 *cm.* } 20 *cm.*

Without a lens, convergent strabismus with diplopia; with lens, fusion.

30) Betty P., æt. 12. " " + 5.5 ; " " + 5
Ophthalmoscope, 5 to 6 D Hm.

	Without lens:	with + 4 ; + 4	with + 6 ; + 6
5.75 *m* . . .	Conv. 11°	Conv. 6°	Conv. 0.4°
1.15 " . . .	" 13°	" 6°	" 0.5°
0.286 " . . .	" 10°	" 6°	" 0

Equilibrium at 16 *cm:* not tested: 28 *cm.*
Fusion far point, Pr. 5°, base in.
Fusion near point, 6 *cm.* 75 *cm.* 75 *cm.*

A slight convergence is actually present in both of these cases, although the values with + 6; + 6 in the latter seem to be a little too small. In the use of such strong convex lenses we must accurately arrange the distance between the centres of the lenses according to the pupil distance, on account of the considerable prismatic effect. The patient has probably been wearing the proper lenses in a frame that was better adapted for a grown-up person.

The approach of the equilibrium point is the reason why, in hypermetropia with convergence, the externi have so much difficulty in performing their task.

In Case 30 we really have an equilibrium point at 28 *cm*, corresponding to 12°, or to a convergence of 3.5 metre angles, but on account of the Hm the externi are compelled to work with the equilibrium point at 16 *cm—i.e.*, with a convergence of about 21°, or 6 metre-angles.

When we see how difficult are the conditions in Hm, we need not be surprised that the latent convergence which occurs at all ages is most often seen in childhood, and then so easily changes into manifest convergent squint. Hypermetropia is the most frequent condition of refraction in childhood, and what is of some importance, surely, the fusion is not so well exercised in the early years of life as is the case in adults.

The treatment has already been suggested under the head of divergent strabismus. Convex lenses are used instead of concave, and if prisms are available they must be used with the base in instead of out as in divergence. On the whole, the essentials of treatment are the same in both.

Most of our patients in this class are children, but we do not see them until they have already developed a periodical squint and got rid of their diplopia. If the periodic squint is still in its developmental stage, we may be able, for some little time, at least, to obviate it by carefully covering the good eye with a shade, and only letting the child look with the eye that has habituated itself to turn inward. He will then be compelled once more to occupy himself with the images formed in this eye, and those halves of the retina whose images were suppressed will again be exercised. If the shade is removed after ten days or a fortnight, fusion will generally be observed, and if it is actually obtained the periodic squint must not have lasted for any length of time.

It may be useful to continue this method of treatment for some time, and then, at a later date, to tenotomize the internal rectus.

If we are actually able, in such small patients, to measure approximatively the degree of the convergence, *i.e.*, the location of the point of equilibrium, or can convince ourselves that the convergence is great enough to authorize us to perform a tenotomy, it must be the most rational step to

operate in this stage, and we shall be more certain of obtaining the desired fusion.

Having thus inquired into the conditions in latent convergent strabismus, I believe, from what has already been said, and from the examples that have been cited, that latent and manifest strabismus are one and the same affection. When the manifest squint develops itself from the latent, the range of fusion will become more or less rapidly limited, so that finally there remains nothing but a point of fusion coinciding with the point of equilibrium.

The degree of the deviation is, of course, the deciding influence whether it shall remain latent or become manifest. If the divergence or convergence is well marked, manifest squint will develop under all circumstances, even if it were not already present from the birth of the child.

In the slighter degrees of deviation other influences come into play, *e.g.*, the refraction, and, more than any thing else, any condition of things that causes a marked variation in the sight of the two eyes, such as anisometropia, congenital amblyopia, maculæ of the cornea, etc., etc. When, among innumerable children who have had phlyctenula of the cornea, we see a few in whom a latent strabismus is developed, it is hard to imagine any thing else than that this must have been present a long time before, but which can now no longer remain latent simply because the image in one eye has become too ill-defined for fusion to be maintained. I once saw a case in which, during an affection of the periphery of the cornea, with a slight shadow over the pupillary field, there ensued a convergent squint, which disappeared again when the affection retrograded and the cornea became clear.

I think that statistics will show that convergence and divergence occur with about equal frequency. The question then will be: Why is convergence so frequent in childhood and divergence so late in its appearance, and why does convergence in children so easily transmute itself into manifest squint, whilst the divergent squint, at least according to my experience, in adults more easily remains latent?

These questions have really been answered. Children are generally hypermetropic, and when convergence is present

beforehand the point of equilibrium will move so far inward that in many cases the externi cannot maintain fusion for any length of time, and the strabismus occurs. This will happen all the more easily in children, since their power of fusion has not been so thoroughly worked up, nor is it so strong, as in adults.

The condition of things is different in latent divergence. Here the hypermetropic refraction in childish years forms an equilibrium against the abnormal muscular relations, and only with increasing age, when the refraction alters, the Hm passes over into Em or My, and when the interni, overtaxed, grow weary from continuous exertion, then comes to light the divergence as a latent, or rather, perhaps, as a manifest, strabismus.

EMBOLISM OF THE SUPERIOR NASAL BRANCH OF THE ARTERIA CENTRALIS RETINÆ.

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(*With two wood-cuts.*)

WHILE acting as clinical assistant under Mr. Gunn in the Royal Ophthalmic Hospital last year I had an opportunity of examining almost daily for three weeks the following case. The only interest that attaches to it lies in the fact that most published cases and most pictures of partial retinal embolism refer one to those changes in the fundus which occur long after the accident has taken place, while in this instance I was able to examine the patient early, and to continue the examination daily thereafter for the period mentioned.

Forty-eight hours before I saw him, H. W., aged twenty-three, clerk, was talking to a friend in the street, when without any warning, he suddenly "lost all the sight in his left eye." He had neither before nor after any sensation of heat or fulness in his head; no vertigo, and no nausea. A few hours after the attack he began to see a little with the affected eye, and the next day could see very well. He applied for advice simply to ask whether he might, without danger, resume work.

He presented the appearance of a healthy young man, and did not complain of any thing except slight shortness of breath on exertion.

When seven years old had an attack of acute articular rheumatism, and since then four other seizures. Each time he was laid up in bed for several months, the last attack taking place nine years

ago. On examining his heart found that he had a hypertrophied left ventricle, while a loud systolic bruit, propagated upwards, could be heard at the mid-sternum. There was well-marked increase of arterial tension.

R. E. V. $= \frac{6}{60}$; $\bar{c} - 2.50$ D sph. $= \frac{6}{6}$ and Jaeger i.
L. E. V. $= \frac{6}{60}$; $\bar{c} - 3$. D sph. $= \frac{6}{6}$ and Jaeger i.
Both eyes = T. n and p. r. n.

Ophthalmoscopic examination of R. E. shows nothing abnormal except a small myopic crescent. L. E., fine floating opacities in vitreous, which make it difficult to see some of the fundus details

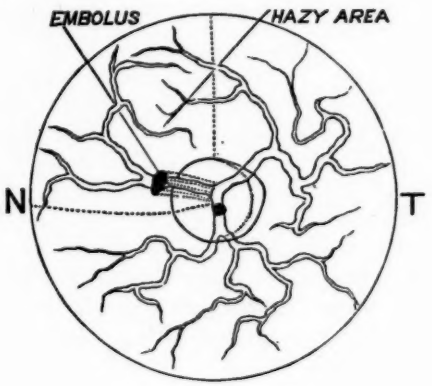

FIG. I.—LEFT EYE.

with distinctness. The upper and inner quadrant of the retina is hazy, but there are no gross changes in this locality. The macula has the normal appearance. The inner half of the O D is redder than the outer, and on its temporal border is a small crescent. There are no hemorrhages anywhere to be seen. Half a disc-diameter from the edge of the papilla, in a direction up and in, is a small, well defined yellowish spot. It lies immediately over, or at any rate obscures, the outline of the *ramus nasalis superior* at that point. The central artery divides about the centre of the disc into two branches, and the division of one of the latter into the usual superior nasal and temporal twigs takes place before the edge of the O D is reached. The whitish spot referred to is

accordingly situated in or about the arterial twig one disc-diameter from its junction with the larger branch, as is roughly shown (arteries only) in the accompanying diagram. That portion of the vessel which lies between the yellowish-white spot and its origin on the papillary surface has a reddish outline, and seems to be swollen. In this situation it has lost its peculiar arterial reflex, and looks as if it might contain a blood-clot. On admission the field of vision for white objects was carefully taken, and a sector-like defect, corresponding generally to the hazy retinal quadrant, was mapped out. A McHardy perimeter was used with the 5 *mm*

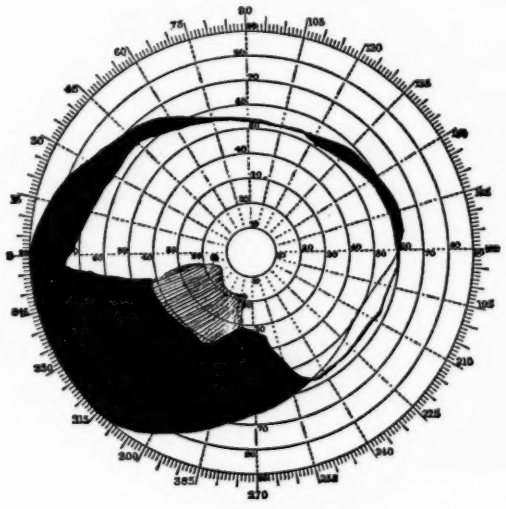

FIG. 2.

object. It will be noticed that an irregular area of indistinct vision for white (no color perception) extends from about the fortieth to the fifteenth parallel in the lower and outer quadrant of the chart. Outside of that, most of the quadrant shows absolute loss of perception of white. The field was taken several times at intervals, and no essential alteration from the result given was noted while the patient was under observation.

A week after the first examination the contour of the vessel between the whitish spot and the papilla is better defined, and the artery itself appears lighter in color, and smaller than before.

Neither the arterial trunk nor its other branches are affected as to color and size. It is doubtful whether the corresponding *vena nasalis superior* is swollen. The œdema continues about the same.

When last seen a clearer picture of the background could be had ; the limits of the retinal haze were quite as pronounced, and they had not extended. The coloring of the choroidal epithelium over the affected area was not visible ; a grayish appearance had taken its place.

Patient has apparently not discovered the absolute scotoma affecting his lower-outer visual field ; or, at least, he has made no complaint of it. There have been no appreciable changes in or about the macular region during the three weeks of observation, nor any "streakiness" of the retina outside of the area of grayish haze.

A REPORT OF FOUR OPERATIONS FOR CYSTICERCUS INTRAOCULARIS.[1]

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Translated by Dr. Ward A. Holden, New York.

THE clinical picture of intraocular cysticercus was left us by Albrecht von Graefe as almost complete, while the chapter on the treatment of this interesting affection—we speak of the operative treatment only, the medicamentous having proved worthless—remained still unfinished at the time of his death. Von Graefe obtained very satisfactory results in the extraction of cysticerci from the vitreous, those, however, in the deepest parts of the eye, especially the subretinal, seemed to him unsuited for operation.[2] In this direction we have advanced considerably in recent years. To Alfred Graefe is due the credit of having first grasped the idea and indicated the method of removing cysticerci from the deepest parts of the eye, making possible the safe extraction of this so pernicious guest, even from the posterior pole. Besides those described by von Graefe[3] there are

[1] From vol. xv., German edition, 1885.

[2] Von Graefe, in his last publication on intraocular cysticerci, in 1866 (*Graefe's Arch.*, vol. xii., p. 190), declared unsuited for operation those cases in which the entozoön lay behind the retina, near the posterior pole. It is interesting to know that he intended, at his first observation of cases of this sort, in 1854 (*Graefe's Arch.*, vol. i., p. 462), to go into the vitreous with a cataract needle, under the guidance of the ophthalmoscope, and kill the entozoön. As far as I have seen, he never carried out this idea. Much later such an operation was performed by von Wecker (*Handbuch von Graefe-Saemisch*, vol. iv., p. 711); it was unsuccessful, and the cysticercus was removed through a scleral incision.

[3] *Graefe's Arch.*, vol. xxiv., 1, pp. 209–232; vol. xxiv., 3, pp. 267–273; vol. xxviii., 1, pp. 187–202.

on record a few cases of extraction of a cysticercus from the region of the macula lutea,[1] and the report of a successful operation of this sort seems permissible. I shall take this opportunity to present also three other observations of intraocular cysticerci, all of which were operated on.

The *first case* was one of *cysticercus in the anterior chamber*, which I diagnosed in the right eye of Mrs. Wilhelmine Buntrock, aged thirty-four, on September 14, 1881. The patient had first noticed the change in the eye eight weeks before. There were no cysticerci on the surface of the body, and she was free from tapeworm; her husband, however, had a tapeworm. The patient counted fingers at eighteen feet; the disturbance of vision was due as well to a brown deposit on the anterior lens capsule as to the presence of the cysticercus, which was the size of a small pea. Changes of form and of position were observed, the head for the most part being drawn in. On September 17th, under narcosis, I extracted the entozoön, which lay at the bottom of the anterior chamber. Close to the sclera I made a linear incision 6 *mm* long with a Graefe knife, holding this as in dividing a corneal ulcer; in this way it was possible to avoid wounding the cysticercus which rested on the posterior surface of the cornea. It came out intact with the aqueous humor; a small portion of the iris prolapsed and was excised. The microscopic examination showed the ordinary characteristics of the cysticercus cellulosæ. The patient was dismissed cured seven days after the operation. The deposit on the anterior capsule of the lens disappeared gradually under the use of iodide of potassium. *On March 29, 1882, the vision of the operated eye was normal.* I saw the patient again some months ago, and at that time the eye was sound excepting the narrow downward coloboma of the iris.

The *second* patient, Mrs. Baitsch, aged forty-two, was received on December 13, 1881, with a *cysticercus in the vitreous of the left eye adherent to the bulbus wall* in the æquatorial region. The patient had noticed dark spots in the visual field of the left eye since June, and since November a progressive failure of vision. In the *visio directa* was a nearly absolute scotoma of 6° radius, the visual field was wanting inward, contracted above and below,

[1] By Becker, at the Heidelberg Ophthalmological Congress of August, 1878 (quoted after Hirschberg, Eulenburg's *Realencyclopädie*, vol. iii., p. 609), then by Cohn (*Centralbl. f. Augenheilk.*, 1878, p. 145), and by Manz (*Arch. f. Augenheilk.*, vol. xiii., pp. 198–202).

and normal outward; the color limits were normal outward; fingers were counted eccentrically at four feet. The anterior segment of the eye was of normal appearance; at the posterior pole of the lens was a small translucent opacity; in the vitreous were a number of waving membranes, partly glistening white. On ophthalmoscopic examination the fundus appeared veiled, its lower half and the disc normal, the outer half of the retina detached. About six disc diameters from the nerve entrance was an intensely white irregularly outlined patch two and a half discs large; the lateral edges of this patch were prominent, most markedly the temporal, which projected into the vitreous as a sharp ridge, and spread out fan-shaped above into the retina. The patch was covered with irregular vessels, none of which passed beyond the sharp ridge; near by was a hemorrhage. When the eye was turned outward as far as possible and at the same time some 30° upward, the observer saw a cysticercus vesicle four discs in diameter, with a sharp convex contour, projecting far into the vitreous. On its surface were a number of small gleaming spots, and beside these a larger one unusually white, probably the head. No movement of this latter could be seen, although there was a wavy motion of the surface and of the edges of the entozoön; no vessels were present. The cysticercus, which was also visible by oblique illumination, was found six days constantly in the same position, and must therefore be considered to have been fixed at this point.

As regards the development of this affection, I believe that the white spot upward and outward from the disc represented the former sub-retinal position of the parasite, and that it had passed through the tent-shaped vascular position of the retina, and so reached the vitreous.

The surface of the patient's body was free from cysticerci, she had never noticed symptoms of tapeworm; a daughter, however, had suffered from tapeworm five years previously. The patient was in the seventh month of pregnancy, yet fearing further changes from a delay, the operation was made on December 19, 1881, under narcosis, and no consequences prejudicial to the general condition followed. Having rolled the bulbus downward and inward, I made a meridional incision with an ordinary bistoury between the rectus superior and the rectus externus, nearer the latter, first cutting through the conjunctiva, then the capsule of Tenon; the incision began 4 *mm* from the corresponding corneal

margin, and was 7–8 *mm* long. The sclera lay bare; I then passed a Graefe knife with its back to the sclera (as in splitting the cornea) into the æquatorial end of the wound, made the counter puncture at the corneal end, and completed the section with a sawing motion; *the cysticercus followed the knife directly*, it lay between the lips of the wound and was easily removed with iris forceps. No vitreous or fluid of any sort escaped from the incision. The slightly gaping wound in the capsule of Tenon and conjunctiva was closed with a suture. The wound was healed by the 27th; the ophthalmoscope showed the wound cicatrix as a narrow white stripe. A year later I found to my surprise that the posterior polar cataract and the opacities of the vitreous had entirely disappeared; central vision had not been regained, fingers were counted eccentrically at five feet.

The *third* case was of *subretinal cysticercus at the posterior pole of the eye.* Mrs. Johns, aged fifty-eight, consulted me January 22, 1884. She had noticed a visual disturbance in the left eye fourteen days before, and eight days before had found the eye nearly blind. The external appearance of the eye was normal, the ophthalmoscope showed translucent punctate and thread-like opacities deep in the vitreous, and in the macular region beneath the slightly changed retina an easily recognizable cysticercus; it was not regularly round, its horizontal diameter measuring five discs, its vertical somewhat less. The nasal margin of the entozoön lay one and a half discs distant from the nerve entrance, the lower margin close to the arteria temporalis inferior, the upper margin one disc distant from the arteria temporalis superior. The retina was detached for a short distance outward from the cysticercus, but appeared to lie close on the surface of the entozoön. From this it must be inferred that the entozoön had previously lain farther to the temporal side and had pushed itself toward the disc. The remainder of the fundus showed no changes. The fields for white, blue, red, and green had normal limits, there was a large central scotoma corresponding to the form of the cysticercus, extending upward 30°, downward 10°, inward 30°, and outward to the blind spot; movement of the hand was recognized within the scotoma. On January 25th the patient was operated on, no change having occurred in the cysticercus. It was proposed in the operation to lay the sclera bare at least to a point 21 *mm* in a direct line from the temporal margin of the cornea; at this point might be supposed to lie the temporal edge of the cysticercus, fol-

lowing the rules laid down by Alfred Graefe, considering the sagittal diameter of the bulbus 24 *mm*, and the half basis of the cornea 5.8 *mm*. In this case I concluded that the given distance was rather too large than too small, the eye axis probably measuring, on account of its hyperopia, less than 24 *mm*. On this ground it might be supposed that the extraction of cysticerci from the deepest parts of the eye would be more easily performed in hyperopic eyes than in myopic.

I began the operation, under narcosis, by dividing the rectus externus, loosening as little as possible its covering conjunctiva, and leaving a bit of tendon attached to the sclera as a guide for the location of the horizontal meridian; the rectus externus was armed with a thread, and then with blunt Cooper's scissors the connection between tunica vaginalis and sclera was loosened in the horizontal meridian as far back as possible, while the bulbus was rotated toward the nose. When the distance between the temporal margin of the cornea and the deepest free-lying point of the sclera was 15 *mm*, measured by the compasses, I made with straight scissors a cut 2 *mm* long through the conjunctiva and capsule of Tenon, which were dissected up, and let my assistants catch the margins of the wound with two small hooks and draw them to the temporal side, while at the same time the bulbus was fixed near the *temporal* margin of the cornea and rolled toward the nose. The sclera lay bare for 19 *mm*; I then passed a Graefe knife, its back to the bulbus, through the sclera far back in its free-lying portion, directed the knife toward the posterior pole, and made a cut 5 *mm* long. The wound did not gape, I had not carried the knife deep enough, and the sclera, as it appeared, was only superficially divided. The cut was so far back that after a slight displacement of the bulbus it could not be found again; I made then a second cut slightly beneath and parallel to the horizontal meridian, passing in the knife 1½ *mm* from the posterior end of the free-lying portion of sclera so deep that I was sure that this had been perforated, made a counterpuncture 4 *mm* farther back, and completed the section with a sawing motion; the cysticercus not presenting itself, I did not go in at once with the forceps, but widened the wound posteriorly with the straight scissors, since it appeared too small; *when the scissors were withdrawn the cysticercus lay in the wound. Neither vitreous nor fluid escaped from the wound during the operation.* The extracted body, as in the preceding case, was verified as a cysticercus by microscopic examination.

The tendon of the rectus externus was attached near the cornea, and the wound of the conjunctiva closely sutured. The wound healed well, and the patient was discharged February 3d, nine days after the operation. *With the ophthalmoscope no cicatrix could be seen.* On March 22, 1885, the patient counted fingers at two feet. With the ophthalmoscope were seen a number of small spots of pigment near the nasal margin of the disc, arranged parallel to it, and at the former seat of the cysticercus a large white patch with pigmented margins.

The *fourth* case was one of *free-moving cysticercus in the vitreous.* Mrs. Quedenfeld, aged forty-nine, presented herself June 10, 1884, stating that for three weeks objects seen with her right eye had appeared clouded; the left eye was slightly hyperopic and astigmatic, otherwise normal; in the right eye the vitreous was filled with five opacities, the fundus was correspondingly clouded but apparently normal, excepting a white patch four discs large upward and a little outward, near the boundary of the ophthalmoscopic field; the view was too indistinct to determine whether vessels were present; from the temporal margin of the white patch ran directly downward a bright narrow stripe, apparently elevated. $V = \frac{1}{3}$ after correction of hyperopic 3 D; the visual field corresponding to this patch is contracted in the 180th meridian to 50° and in the 200th meridian to 35° (Förster's new diagram), elsewhere the fields for white and for colors are normal. I soon conceived the idea that this white patch was not a simple choroideal exudate, and the white stripe recalled the former case of cysticercus; no movement could be seen however. On August 14th, the patient returned saying that for several days she had noticed a dark blotch before the eye; at first glance one saw a large naked green cysticercus with iridescent borders; the long slender neck with the head was stretched downward, and, like the vesicle itself, was in active motion.

The cysticercus had apparently developed between the choroidea and retina, then pushed itself toward the ora serrata. For this reason the ophthalmoscope did not at first discover it; the white patch represented its former position, the white stripe its course between choroidea and retina. Finally it had left its concealment under the retina, had perforated this, and had passed into the vitreous.

The operation was performed at once. The patient was chloroformed in a half-sitting posture. After the introduction

of the speculum I seized the bulbus in the vertical meridian and rotated it upward. The distance between the margin of the cornea and the limit of visible sclera was 16 *mm*, as measured by its compasses; I divided the conjunctiva and capsule of Tenon 3 *mm* outside the vertical meridian and parallel to it, until the sclera lay exposed. In cutting through the bulbus wall I carried the knife in the manner stated, pushing it, however, from above downward, as I should not have been able to sink it sufficiently if I had inserted it near the æquator. The wound was about 7 *mm* long, 6 *mm* from the margin of the cornea, and gaped sufficiently; normal vitreous stood in the wound but did not prolapse. I passed the forceps into the vitreous in various directions but did not succeed in seizing the cysticercus, which just before the operation had lain in the position stated above; I concluded that it had passed the boundaries of the ophthalmoscopic field. A second attempt to grasp the cysticercus failed; I then gave up the operation, which had reached the allowed limit, put one catgut suture in the sclera and two in the conjunctiva, and bandaged both eyes. On the 17th an ophthalmoscopic examination *revealed the cysticercus lying upward and outward.*

On October 1st the eye appeared normal externally, the vitreous, however, was much more clouded, and the cysticercus could not be seen; the patient distinguished only the hand, and perception of light was abolished in the upper field. In the middle of October the right eye appeared a little smaller than the other, it had become suddenly soft; the patient complained of pain in the whole right side of the head, and later of flashes of light in the left eye and inability to use it. In the beginning of November a yellow spot appeared low down in the vitreous, visible even by daylight, and as vision was almost entirely lost and ophthalmia sympathetica was feared, the eye was enucleated, November 2d; the left eye remained sound.

It struck me at once on looking at the enucleated bulbus that the cicatrix was drawn in at one point, while in life it had shown no such change. It seemed desirable to have the bulbus examined for micrococci; the investigations of Deutschmann have made it seem probable that the so-called ophthalmia sympathica arises from the migration of cocci from the irritating eye; I suspected that the enucleated eye might have caused ophthalmia sympathica. Professor Baumgarten had the kindness to carry out this investigation, and to present me with the following report:

"Externally the enucleated bulbus shows on its under surface a shallow radiate cicatricial retraction of the sclera of about pin-head size, several millimetres from the corneal margin. The bulbus is soft. After dividing it by an æquatorial section with a sharp razor, a funnel-shaped total detachment of the retina is seen; the space between choroid and retina is occupied by a clowdy-brown fluid. Corresponding to the scleral cicatrix the detached retina is adherent to the two outer coats of the bulbus. The detached retina encloses a soft yellowish-gray mass, the altered vitreous, the inner portion of which forms the capsule for a large, well-preserved cysticercus vesicle 11 *mm* in diameter. The inner surface of this vitreous cavity harboring the cysticercus has macroscopically the appearance of a muco-purulent substratum, but on microscopic examination it proves not to be a purely free purulent exudate, but a purulently infiltrated partly fatty degenerated granulation tissue. Dry cover-glass preparations of this tissue show under a homogeneous immersion objective (Zeiss $\frac{1}{12}$, oc. IV.) a few small micrococci, mostly single, some in pairs.

"Microscopic sections through the scleral cicatrix and the adherent neighboring inner part of the eye show in the former the presence of a typical cicatricial tissue, whose fibres cross the connective tissue fascicles of the sclera at right angles. This cicatricial tissue joins internally a new-formed fairly vascular connective tissue filling a defect in the choroid equally large with the scleral cicatrix, then passes through the retina, replacing its specific texture more or less completely, and continues into a richly vascular granulation tissue of transformed vitreous. In this latter lie embedded a number of well-formed hæmatoidin crystals and granular hæmatogenous pigment; the inner layers of the metamorphosed vitreous bounding the cysticercus are crowded with close-lying fatty-degenerated pus corpuscles. None of the usual methods show any sort of bacteria in section preparations of the cicatricial tissue of the sclera, choroid, and retina, nor in sections of the transformed vitreous. The same is the case with the opticus and its sheaths, which show nothing that might be considered a deposit of bacteria. Nor is this an abnormal cellular infiltration of the opticus and its sheaths."

The failure in extracting the cysticercus in the last case may be attributed to its movement in the vitreous. Had

the entozoön kept the position which it held just before the operation I am convinced that the extraction must have succeeded.

My three cases of cysticercus in the posterior segment of the bulbus show, by a curious chance, the **three varieties** which Alfred Graefe distinguished as regards the **prognosis of the operation,**[1] viz., (1) a subretinal cysticercus, (2) a cysticercus adherent to the bulbus walls, and (3) a cysticercus in the vitreous. My small material confirms the experience of this investigation that the cysticercus of the last-named variety offers the least chances for a successful operation.[2] We may proceed more confidently to the extraction of a cysticercus in the region of the macula lutea than to the extraction of one freely movable in the vitreous. This sounds at first strange, yet it is supported not only by theoretic reasons, but also by the experiences of Alfred Graefe and those here reported.

In this respect the results which Albrecht von Graefe obtained in extraction of cysticerci from the vitreous are remarkable. In his last comprehensive publication on his experiences with intraocular cysticerci,[3] von Graefe states that since his last report (*Arch. f. Oph.*, vol. ix., 2, p. 180) he "has never made the there recommended æquatorial incision without bringing out the entozoön fully intact." He says,[4] two years later, in a publication "on the wider application of the peripheral linear incision": "Since I have employed the peripheral linear incision almost exclusively, in a period of nearly two years, I have brought out the entozoön fully intact in almost every case." In spite of this statement I cannot recommend, in place of the simple meridional incision, excision of the iris and extraction of the sound lens for the removal of a movable cysticercus in the vitreous. The linear incision carries with it, according to experience, the danger of causing sympathetic inflammation in the other

[1] *Graefe's Arch.*, vol. xxviii., 1, p. 189.
[2] Alfred Graefe had, out of twenty-four cysticercus operations eight unsuccessful results, and of these eight cases seven were cysticerci in the vitreous (*Graefe's Arch.*, vol. xxviii., 1, p. 189).
[3] *Graefe's Arch.*, vol. xii., 2, p. 190.
[4] *Graefe's Arch.*, vol. xiv., 3, p. 145.

eye,[1] a danger which demands special consideration, since eyes blind from cysticercus might still cause an ophthalmia sympathica.

Regarding the location of the meridional incision for the extraction of movable cysticercus in the vitreous, we may learn from von Graefe's operations, the results of which were more favorable than those of the method now in use, that the meridional incision should be made at such a place that traction instruments may be most readily introduced into the interior of the eye (below and outward, or below and inward).[2]

While the prospect of the successful extraction of a subretinal cysticercus, or of one adherent to the bulbus wall, is so much the greater the more exactly one strikes the seat of the parasite, there is no purpose in incising the bulbus at a point corresponding to the cysticercus when it is movable, as one cannot be sure that it will keep its former position after the incision is made. Secondly, it may be recommended to carry in the traction instruments after the bulbus is opened, under the guidance of the ophthalmoscope. If the operator gets the cysticercus in view—as may mostly be the case—he renders himself independent of the caprices of fortune to which otherwise he is subject. It seemed to me justifiable to call attention to these last two points, although I have no experience as to their practical utility; possibly with attention to them a favorable result might be obtained in cases similar to mine.

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[1] The possibility of ophthalmia sympathica after a meridional incision must be granted; a consequence of this sort has not, to my knowledge, been observed however. If ophthalmia sympathica be an infectious disease, as Deutschmann has made it seem probable, we can in no better way guard against this unfortunate accident than by treating antiseptically the wound so far as this is possible in the eye.

[2] *Cf.* von Graefe, *Graefe's Arch.*, vol. xii., 2, p. 188, and Hirschberg, Eulenburg's *Realencyclopädie*, vol. iii., pp. 605 and 606.

A CASE OF SUCCESSFUL EXTRACTION OF A CYSTICERCUS FROM THE VITREOUS WITH THE AID OF THE OPHTHALMOSCOPE.[1]

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Translated by Dr. Ward A. Holden.

AN unsuccessful attempt at extraction of a free-moving cysticercus in the vitreous, which I reported in 1885, showed me clearly the unreliability of the operation hitherto practised for the removal of the entozoön in this position. As excellent, thanks to Alfred Graefe, as are the results of the extraction of cysticerci from the posterior segment at the bulbus when they are fixed in position—whether subretinal, or in the vitreous adherent to the bulbus wall,—just so unsuccessful are the results when they are movable in the vitreous. In Alfred Graefe's twenty-four operations, seven of the eight failures were in cases of movable cysticerci in the vitreous. The reason for this is evident. When the entozoön is fixed, we can estimate its location with sufficient accuracy, following Alf. Graefe's rules, and make the incision at that point. With a movable cysticercus in the vitreous, an accurate estimation of its location will not guarantee a successful result, since the entozoön, as I found in the case cited above, may change its seat in the course of the operation. On account of these considerations, in closing my communication at that time, I made this proposition for the extraction of free-moving cysticerci from the vitreous:

[1] From No. 3, vol. xxi. of German edition, 1890.

1. To incise the bulbus at a place convenient for the introduction of instruments regardless of the situation of the cysticercus, and

2. To carry traction instruments into the vitreous with the aid of the ophthalmoscope and so extract the cysticercus.

An opportunity for such an operation presented itself in the autumn of 1886.

On Sept. 27, 1886, a patient came to me with a cysticercus in his left eye. It lay in the unclouded vitreous, and could be diagnosed with certainty at the first glance. There could be seen not only the sharp-contoured circular vesicle having a pronounced hydatid gleam, but in the lower outer quadrant of the vesicle, the fully extended neck with the head, and on the latter four suckers, almost as distinct as in an anatomical preparation. The neck and the head, together with the vesicle wall, were movable, and movements could be recognized even in the suckers.

The cysticercus lay in the upper inner quadrant of the anterior part of the vitreous, and could be seen by lateral illumination; its temporal margin came into view when the eye was turned about 20° upward from the horizontal and slightly to the nasal side; its lower margin became visible when the eye was turned 30° to the nasal side and a few degrees upward. The fundus reflex was perceptible about the vesicle near its margin.

The entire retina was detached, is lower half very deep and irregular; it undulated considerably and seemed opaque and gray-white, while the upper half appeared still somewhat transparent.

The vision was consequently almost entirely lost, the patient having an uncertain perception of light, relatively best upward.

Form and tension of the left eye were normal. The right eye was sound; it was emmetropic and had normal vision.

On repeated examination, the cysticercus was found constantly in the same situation in the vitreous, its head being at times more completely extended, mostly downward and to the nasal side, only once outward; at other times quite drawn in and then recognizable as an intensely white gleaming spot.

On October 8th, for the first time, the head could not be seen. The cysticercus had turned, without changing its location in the vitreous.

On October 12th I performed extraction according to the principles laid down above. The patient did not fear the operation,

and agreed that it should be performed with cocaine. This facilitated the execution of the operation; it could of course also have been made under chloroform narcosis. The patient sat opposite me on a chair. I first made a meridional cut in the lower outer quadrant of the globe, entering a straight lance in the direction toward its centre; the incision was about 10 *mm* long, beginning 6 *mm* from the margin of the cornea. When the patient, who was well trained from previous repeated examinations, brought the eye into the position in which always hitherto, and just before the incision, the cysticercus had been visible, I did not see it. I found it when the eye was turned straight upward as far as possible, its lower margin then becoming visible. I now passed in an iris-hook, whose movements I could clearly follow; first to the lower margin of the cysticercus, then above and behind it, while at the same time I turned the point of the hook toward the cysticercus and tried to catch it. *At the first attempt the hook slipped off, the second time the parasite followed and was removed from the bulbus.* The vesicle was not at all, or but slightly, collapsed. On the preparation preserved in pure glycerine one can still recognize to-day the triangular flap wound made by the hook. A small quantity of vitreous escaped from the wound with the entozoön; this had not prolapsed when the section was finished. The vitreous had not its normal consistence.

After using iced compasses for some minutes, the wound was thoroughly washed out with sublimate 1 : 5,000, then closed by a deep conjunctival suture, and covered with iodoform. The ophthalmoscope used in the operation was fastened to a head-band, and by a ball-and-socket joint was movable in every direction.

The recovery was smooth. On October 26th there was a slight injection of the bulbus, there were four bands in the deeper parts of the cornea, and the pupil was medium wide. The wound was fully cicatrized and smooth, with a bit of pigment healed into its nasal end. The intra-ocular pressure was normal, the eye was not sensitive to the touch. On ophthalmoscopic examination the vitreous appeared quite normal and the path of the hook could not be seen. V = 0.

After his dismissal the patient returned from time to time. On December 9th, almost two months after the operation, the vitreous still appeared clear; it seemed that the bulbus felt softer than before. Fourteen days later I found, below and outward in the

vitreous corresponding to the wound cicatrix, a whitish-yellow vascular membrane of triangular form, with its long side toward the bulbus wall; a large hemorrhage was below the membrane, and numerous small spots of blood were on the detached retina.

The membrane enlarged little by little; when last I saw the patient, March 3, 1887, it had invaded the whole breadth of the vitreous.

The eye was not irritated, was nowhere sensitive to pressure, and its tension was slightly diminished; the anterior chamber was somewhat flattened below and outward; the pupillary margin corresponding to this part was adherent to the lens capsule, elsewhere free; the lens was clear. The patient was no more conscious of this eye than of the sound one.

On December 19, 1889, in reply to my inquiry, the patient wrote me: (1) that the right eye was quite sound; (2) that the pupil of the eye operated on looked gray, excepting a crescentic stripe at its upper margin, which appeared black; (3) that this eye was a little smaller than the sound one.

In our patient there was a free-moving cysticercus in the nasal half of the vitreous of the left eye; it was not adherent to the bulbus wall. The cysticercus just before the operation lay in the upper-inner anterior quadrant of the vitreous, and immediately after the ending of the section it lay in the upper half of the vitreous, but so far forward that only its lower margin could be seen. There can be no doubt but that, under such circumstances, *without the aid of the ophthalmoscope*, the operator is at the mercy of blind chance, and that in the majority of cases the extraction of a movable cysticercus from the vitreous fails. On the other hand, the chances of success in the operation are certainly not unfavorable if the interior of the eye is illuminated by the ophthalmoscope. The problem which the operator has to solve consists in the extraction of a vesicle about 4 *mm* in diameter from a spherical body about 17 *mm* in diameter, with almost fluid contents. I believe, then, that the extraction of a cysticercus movable in the vitreous will succeed in most cases, or at least more frequently than heretofore, if the operator makes use of the ophthalmoscope in the operation.

A second question, none the less important, is naturally *how the vitreous and the eye in general tolerate this interference.* I shall merely remark, regarding this point, that in my case the result fulfilled all reasonable demands: the operated eye held its form; it did not become phthisical; it did not arouse sympathetic inflammation in the second eye. In order to preclude all doubt as to the points just mentioned, I have waited three years with my publication. The present condition may surely be regarded as stationary. Since the eye, before the operation, was almost blind from amotio retinæ, nothing can be concluded from my case respecting this point. The course of this case was peculiar, in that for two months following the operation the vitreous remained clear, so that the path of the hook inside the eye could not once be seen. Only after this length of time was a yellow vascular membrane developed, starting from the cicatrix and gradually invading the entire breadth of the vitreous chamber. While the cause of the development of this inflammation does not appear clear to me, I should assume that it need not be sought in the escape of contents of the entozoön. If the latter had been irritating to the vitreous, the effect must have shown itself soon after the operation. My case seems to show that there should be no objections on this ground to my procedure. Furthermore, the conditions were here especially unfavorable, as the parasite lay far upward and the instrument therefore had to describe a long course in the vitreous.

I selected as a *traction instrument* a strong iris hook made for this special purpose; I had also fine straight iris forceps, made with sufficiently long branches, in case the hook tore through the cysticercus wall. The hook is to be preferred, as it disturbs the vitreous structures much less than forceps, which must be carried in closed, opened within the vitreous, and again closed.

In incising the bulbus, I use a lance, paying attention to the distant seat of the entozoön, in order with a sharp instrument to divide the vitreous structure in the direction in which the traction instrument was to be introduced. I here followed an idea, suggested by Hirschberg, if I remem-

ber rightly, for the extraction of pieces of steel from the interior of the eye by the electro-magnet. When one can reach the cysticercus by a shorter path than in my case, the cutting through the bulbus wall with a Graefe linear knife would involve a slighter trauma to the vitreous.

Finally the place where the eyeball should be opened must in the first place be regulated by the position which the bulbus must take, in order that the operator sitting before the patient may see the cysticercus clearly with the ophthalmoscope, and at the same time conveniently reach the cysticercus from the wound. If the operator is right-handed only, the conditions are more favorable, when as in my case the eye is the left.

In conclusion, I must not forget to remark that I have been and am now aware that the operation under consideration is a severe one. Its danger, however, appears to me not disproportionate to the danger of the affection for which it is practised. For this when left to itself ends as a rule in phthisis bulbi, and as Alfred Graefe's statistics show, the operative procedure hitherto practised could not prevent this in most cases.

Whether the ophthalmoscope can be used with advantage in other operations in the vitreous, *e.g.*, in the extraction of foreign bodies, experience alone can determine. It seems strange that hitherto in operations in the posterior segment of the eye, the illumination of the field of operation by the ophthalmoscope had not been tried. A single report of this sort is known to me in the literature. This was by Wecker[1]; he tried with the aid of the ophthalmoscope to pierce a cysticercus lying downward and inward from the disc, using a very narrow Graefe cataract-knife. The operation failed, since the entozoön escaped the point of the knife. The symptoms of irritation were very slight after this interference.

In connection with the case described above, I shall report

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[1] "Handbook of Graefe-Saemisch," vol. iv., page 711.
Knapp used it in three cases, for the removal of foreign bodies from the vitreous.—H. K. Published ARCH. OPHTH. AND OTOL., vol. vii., page 337 *et seq.*, 1878.

briefly a **successful extraction of a subretinal cysticercus,** which I performed in September, 1889.

In a lady, aged thirty-one, having the anterior segment of the globe normal, the parasite was recognized through dense membranes in the vitreous, when the patient turned the eye as far upward as possible and at the same time a little outward. The head could be recognized as a gleaming white spot seldom moving; over the vesicle retinal vessels were clearly seen. When the eye was turned 45° outward, the temporal margin of the entozoön came into view, and when turned 10° outward, the nasal margin, both sharply defined. The nasal half of the retina lay on the choroid, the temporal was detached; there was a paracentral scotoma 20° in extent.

The vision was = fingers at three metres, apparently with central fixation, not improved by glasses.

On September 24th the cysticercus was extracted in the following manner: I first marked on the cocainized eye the vertical and horizontal meridians near the upper and outer margins of the cornea, by small superficial cuts in the conjunctiva bulbi. The patient was then deeply chloroformed. While the assistant rotated the bulbus downward with forceps fixed at the upper margin of the cornea, I cut the bulbus in the direction of the bisecting line of the upper half of the upper outer quadrant, from outward inward, layerwise, first the conjunctiva, then the capsule of Tenon, and, after completely checking the hemorrhage, the sclera. As the scleral wound gaped only in its middle portion, and not at the angles, I divided these parts with straight scissors, first toward the æquator, then toward the cornea. *The cysticercus escaped of itself immediately after the second cut of the scissors, without the loss of a drop of vitreous from the wound.* The wound was about 10 *mm* long, and began about 6 *mm* from the corneal margin.

After the use of iced compresses, the wound was washed out with sublimate 1:5000, the conjunctival wound closed by three sutures, dusted with iodoform, and both eyes bandaged.

The healing went on without accident.

On testing the vision accurately, ten days after the operation, the patient complained of a dark spot in the middle of the field, fingers were barely recognized at two metres' distance by eccentric fixation outward. After some weeks, as the vitreous cleared

under the use of pilocarpine injections, the cause of the positive central scotoma revealed itself as an intense white sharply bounded detachment of the retina, projecting tent-shaped into the vitreous, beginning at the disc and gradually broadening upward and outward to the periphery, and including the macular region. The remainder of the retina was not detached. Since before the operation the eye had central fixation, and detachment of the retina near the disc and macula was not diagnosed with certainty with the ophthalmoscope, we must conclude that following, and probably in consequence of, the operation, a retinal detachment had developed, or increased, at the macula. A long course of treatment did not improve the condition.

In this patient the cysticercus lay at the upper boundary of the opthalmoscopic field. In estimating the position for the wound, I assumed that the anterior boundary of the part of the fundus visible with the ophthalmoscope lay a little anterior to the æquator, for the reason that the fundus can be seen for a short distance only—2–3 disc diameters—anterior to the points of exit of the venæ vorticosæ. The venæ vorticosæ, however, according to the painstaking investigations of Fuchs,[1] enter the inner surface of the sclera $2\frac{1}{2}$–$3\frac{1}{2}$ *mm* posterior to the æquator. Since now in a schematic eye 24 *mm* long the æquator is distant, following the chord, about 12 *mm* from the corneal margin, as direct measurement on Graefe's schema[2] shows, I had estimated that the middle of the parasite lay about 12 *mm* from the corneal margin. Meanwhile the very accurate computations and observations of Groenouw,[3] touching the question of the anterior boundary of the ophthalmoscopic field, have been published in the last number of *Graefe's Archives.*

Groenouw came to the conclusion that the boundary sought lay 8.5 *mm* from the margin of the cornea. In confirmation of his investigations, he gives an observation of Laqueur's,[4] who recognized with the ophthalmoscope the anterior end of a scleral wound, made with a lance for a magnet extraction, ending 10 *mm* from the corneal margin.

[1] *v. Graefe's Arch. f. Ophth.*, vol. xxx., 4, p. 23.
[2] *L. c.*, vol. xxiv., 1, p. 212.
[3] *L. c.*, vol. xxxv., 3, p. 29.
[4] *Centralbl. f. Augenheilk.*, 1888, p. 291.

In the question under consideration, the second of the four cysticercus operations, which I reported in 1885, is of value. The posterior end of the scleral wound lay 11–12 *mm* from the margin of the cornea, and was seen with the ophthalmoscope for a distance of one disc diameter, on the boundary of the visible fundus; the latter lay therefore 9.5–10.5 *mm* from the margin of the cornea. This case becomes the more valuable for our question from the fact that the Graefe knife was passed perpendicularly through the sclera, and consequently the inner wound corresponded accurately to the outer. I should conclude from the observation of Laqueur, and from my own, that the possible error of Groenouw's computation, which he estimates as 1 *mm*, should be counted rather toward the positive than toward the negative side.

A CASE OF METASTATIC CARCINOMA OF THE CHOROID.

By Dr. S. SCHULTZE, of Frankfurt-o-O.,

late assistant at the university eye clinic in Berlin.

(*With plate ix. of vol. xxi., Germ. ed.*)

Translated by H. Knapp.[1]

WHILE it is well known that primary tumors of the choroid have often been observed, metastatic ones are very rare. So far only four cases of the latter have been laid down in literature, and they all were metastatic carcinomata, which developed rapidly and were soon followed by detachment of the retina and complete amaurosis.

The first case is described by Perls (*Virchow's Archiv*, vol. lvi., p. 437). The following condition was found at the autopsy of a person who had died of primary carcinoma of the lungs:

In the left eye: retina detached on inner and lower sides. Along the whole extent of the posterior half of the eyeball the choroid enlarged to 2 *mm* in thickness, almost as hard as cartilage, forming, near the surface, round opaque, white, slightly prominent and uneven tumors, of which almost all had a somewhat depressed centre. Right eye: the retina adheres to the choroid. In the choroid there are also several infiltrations, slightly prominent, about the size of a bean, similar to those of the left eye. A certain number of the infiltrations are situated in the deeper layers of the choroid, covered in

[1] From vol. xxi., No 3, Germ. ed. 1890.

many cases by a thin, vascular, brownish layer. Several single and quite small infiltrations, of 0.5 to 1 *mm* in diameter, entirely white on their surface, lie upon the pigment layer. The larger infiltrations reach to the sclera, and are, in part, firmly connected, with or without, however, penetrating into it.

On sections the infiltrations are opaque, yellowish-white, dry, partly friable, and, especially in the larger ones, closely packed, yellowish plugs are noticed embedded in a bluish-white, prominent, and harder substance. Under the microscope numerous canroid pearls are found in all infiltrations, freely anastomosing with one another, separated by a scant, fibrillar matrix, which contains, here and there, oblong nuclei and oval, spindle-shaped cells, as well as deeply colored corpuscles of the same structure as the normal pigment cells of the deeper layers of the choroid. In the capillary layer of the choroid, near the infiltrations, were found more or less enlarged capillaries filled with carcinoma cells, consequently an embolism or implantation of carcinoma cells.

The second case was presented in November, 1882, by J. Hirschberg at the Berlin Medical Society. It referred to a woman, aged fifty-two years, who had been suffering nine years from carcinoma of the right breast. The disturbance of vision in the right eye existed six months, that in the left two months.

Through the ophthalmoscope could be seen on both sides a flat, cake-like, hard thickening of the choroid, by which the retina was raised. The neoplasm showed itself first above the optic nerve, later also below it; its height was over 2 *mm*. The rapid growth of the tumor as well as the constant diminution of vision could be observed until her death, which occurred in the spring of 1883. An autopsy was unfortunately not permitted. (Eulenburg's *Realencyclopädie*, vol. xiii.)

The third case was also presented in November, 1882, before the Berlin Medical Society by Schöler. A few months later, after the death of the woman, aged thirty-three years, who for six years had been suffering with cancer in the left breast, the eyeballs and microscopic experiences were

demonstrated by Dr. Ulthoff in the Berlin Medical Society. Carcinomatous degeneration of the choroid was found in both eyes and larger retrobulbar carcinoma nodes in the retina of one eye.

The fourth case was communicated by J. Hirschberg, (Eulenburg's *Realencyclopädie*, xiii.).

In February, 1884, a woman of twenty-eight years, was examined,who had had her right breast removed on account of carcinoma in 1884. She said her left eye had become blind a short time ago. Ophthalmoscopically a dark greenish-gray vesicle, resembling detachment of the retina, was discovered in the lower half of the globe; perception of light absent, tension diminished. The right eye was normal. End of February death occurred. The hardened eyeball showed in the section a large tumor of the choroid, adjoining the sclerotic, protruding into the interior of the eye with its smooth, very convex, anterior surface, terminating toward the front in the equatorical region with a sharp, round edge toward the back, and covering the entrance of the optic nerve. An encroachment upon the sclera could nowhere be ascertained. The microscopic examination showed an epithelial carcinoma with extensive hemorrhages. The retina was raised in the shape of a funnel, and highly degenerated.[1]

To the four above described cases the following may be added. This case came under observation in the private clinic of Schweigger, in Berlin, and was very kindly given over to me for description.

Mrs. X., thirty-four years old, came for the first time to the consulting-room. She stated to have noticed, for about three months, a diminution of sight in the left eye, accompanied latterly with lachrymation and pain.

The pain radiated over the forehead and face (in the region of the trigeminus), and occasionally was increased to severe attacks. The external aspect and tension of both eyes were normal. Left with $-\frac{1}{60}$, S $= \frac{5}{6}$, right S $= \frac{5}{5}$. Ophthalmoscopically

[1] A. SCHAPRINGER, of New York, published another "Case of Metastatic Carcinoma of the Choroid," in N. Y. *Med. Presse*, Sept. 18, '88, and N. Y. *Med. Journal*, '89, p. 109. (See an abstract of the case in THESE ARCHIVES, vol. xviii., 1889, p. 228.—H. K.)

a detachment was discovered in the upper-outer part of the left retina, which extended toward the papilla as far as two disc-diameters, with projecting sharp boundaries. Nothing like a tumor could be seen through the detached retina, nor could a rupture of the retina be discovered. A defect existed in the inner-lower part of the visual field. The probable diagnosis was *tumor intraocularis*. On further inquiry it was found that a carcinoma of the right breast and swelling of the glands in the right axilla were noticed in July, 1887, and that on the 5th of December, 1887, v. Bergmann amputated the right mamma and removed the (carcinomatous) lymphatic glands of the right armpit.

When the patient came again on September 3, 1888, a complete detachment of the retina was found in the left eye. S = o. Pupil large and without reaction. Under the upper-inner part of the conjunctiva there was a flat, reddish swelling, having the appearance of an episcleritis. For some time the pain in the eye had been diminishing; on the other hand, the patient complained of severe pain in her whole left side.

The left eye was removed on September 4, 1888. A few days later the patient went home with an artificial eye. The pain in the limbs increased, the left arm and leg became atrophic. As nothing could be discovered on the peripheral nerves, a multiple carcinosis inside the spinal canal was assumed. October 12, 1888, the patient died of bulbar paralysis, as I was informed by the attending physician, Dr. Lobeck. No autopsy was made. The right eye had remained perfectly normal.

The enucleated eyeball was placed in Müller's fluid for two months, then washed out, put in alcohol, divided meridionally, embedded in celloidin, and cut in numerous sections.

The sagittal diameter of the hardened eyeball was 24 *mm*, the transverse diameter 22 *mm*. The anterior parts (cornea, anterior chamber, iris, corp. cil., lens, etc.) were normal. The retina was entirely detached and rose from the entrance of the optic nerve on both sides in a direct, slightly undulatory line almost touching the posterior surface of the lens, then curving about 2 *mm* to the right and left it detached itself close to the corp. cil. The vitreous body was thus shrunk to a cone. The space between the retina and sclera was mostly filled by uniformly coagulated, clear exudation. In the upper half of the eye-

ball there was a flat, cake-shaped choroidal tumor intimately connected with the sclera (see right side of drawing). It began in front about 4 *mm* below the corp. cil., gradually enlarging toward the optic nerve, at which it terminated, overlapping at the entrance with a round border. Its internal surface was nodular and as black as the rest of the choroid. The retina was closely united to the lower edge of the tumor to the extent of about 2 *mm*. The tumor measured at its base 19 *mm* by 16 *mm*, and was 5 *mm* thick. Laterally and anteriorly gradually the tumor merged into the choroid. The color of the tumor was brownish-green on the surface, shading into black-green toward the periphery. In the anterior third of the tumor the sclera was very much thinned, relaxed, and pervaded with dark masses of the tumor. In the posterior, inferior part of the eyeball (left side of the drawing), 8 *mm* above the entrance of the optic nerve, separated from the large tumor by a space of at least 7 *mm* in width, there was a second, small, flat tumor of the choroid, bean-shaped, and entirely covered by dark pigment, slightly uneven on the upper surface, sharply limited toward the sclera, and everywhere gradually passing into the level of the normal choroid. It was 5 *mm* broad, and 2 *mm* thick. In the section its color was evenly blackish-green. The greenish color was, of course, caused by the chromate of potassa, and had probably been much lighter, more yellowish-gray, when fresh.

Microtome sections were made from all parts of the larger tumor. The smaller tumor was divided into an interrupted series of sections.

The sections of the larger tumor showed the following conditions: The internal surface was completely covered with the normal pigment epithelium and columnar layer of the retina. The club-shaped posterior end of the tumor replaced the lower portion of the optic-nerve fibres, but nowhere the intrusion of tumor elements into the opticus or its sheath could be shown. In its anterior third the base of the tumor was separated from the sclera. In the two posterior thirds the sclera was perforated by tumor masses and considerably thinned. It still clearly showed a small-celled infiltration.

The tumor proper consisted of a delicate meshwork of connective tissue, in the broad interstices of which large cells were accumulated. The cells were irregularly polygonal (Fig. 3), and each contained either one or several large vesicular nuclei, which stained pale with carmin and hematoxylin, often contained distinct dark nuclei and were surrounded by a considerably lighter layer of protoplasm. The size of the cells varied from 10 to 50 μ. The interstitial tissue consisted of delicate anastomosing connective-tissue trabecles, enclosing numerous small, round, spindle-shaped, dark-colored nuclei, as well as a number of black-brown cells, identical with those of the choroid. In parts the interstitial tissue increased in bulk and showed a denser small-celled infiltration and some vessels. On the whole, the tumor had but a few vessels, only where it passed into the normal choroid numerous large vessel lumina were found, engorged with red and white blood corpuscles. Besides these parts, which entirely corresponded to those of a carcinoma simplex, the tumor contained extensive necrotic patches, corresponding to the central, macroscopic, lighter-colored parts, in which the frame-work of connective tissue was distinctly preserved; the cells, however, were unstained and had undergone fatty degeneration. In these necrotic parts repeated hemorrhages had taken place, recent as well as older ones: in the former the single blood corpuscles inside the tissue could be clearly recognized; the latter consisted only of heaps of reddish-brown clusters of hematoidin crystals.

The small tumor is also firmly attached to the sclera; the boundary toward the sclera is, however, sharply defined on all sides, nowhere does the tumor penetrate into its tissue. On both sides the choroid was very much thickened, loosened by the tumor masses, infiltrated with small cells, and in each section the swollen venous blood-vessels were very distinct and numerous. Toward the interior of the eyeball the tumor was covered by the well-preserved pigment epithelium of the retina and basal membrane, beside which almost each section showed from one to three remarkable small flat deposits of the pigment epithelium. These deposits were formed by a granular, non-staining mass containing a few spindle-shaped cells and pigment

groups, and were covered by a single layer of spindle-shaped cells. The pigment epithelium of the retina lay under these flat intumescences, which proves that we had not before us the well-known warty excrescences of the lamina vitrosa of the choroid.

The small tumor corresponded in its structure entirely to the larger one, only that the necrotic parts were missing. In the delicate network of fine connective-tissue fibres, which contained pigmented and spindle-shaped cells, typical cancerous cell-nests lay closely packed, touching the basal membrane at the top and the sclera at the bottom, at times pushing at some parts into the relaxed choroid (Fig. 2). From the two hundred sections into which this tumor was cut, about twenty successive ones showed an interesting secondary condition. Between the lamellæ of the sclera a large vein passed diagonally from above downward, in some sections almost below the whole base of the tumor, *i.e.*, at a length of about 3 *mm* (comp. Fig. 2). It had normally thin walls, and while passing through the sclera its normally wide lumen was filled with closely packed red and scant white blood corpuscles; only for a short distance, about in the middle, the contents were more granular and showed a distinct net of fibrine. Above the sclera the lumen gradually enlarged, so that the tumor seemed to have been pressed upwards. The vessel terminated in the tumor with a pear-shaped enlargement (Fig. 2), ran in another direction, and thus left the plane of the section. The club-shaped swelling of the vein in the region of the tumor was filled with a thrombus, consisting of the same magni-nucleated epithelium cells of which the tumor was composed, and the centres of which had already undergone granular degeneration. The thrombus was tightly fastened to the superior vascular wall, which was distinctly thickened, and in a number of sections it could be clearly seen how the vascular wall was perforated by the tumor; tumor and thrombus there merged; the tumor had penetrated into the vessel. At this place the tumor itself had no longer its largest dimensions, being about 4 *mm* in breadth and 1.5 *mm* in height. A broad space on the whole lower and anterior sides, between throm-

bus and vascular wall, contained some normal red and white blood corpuscles, a proof that the circulation had not entirely ceased; the thrombus was therefore parietal, not yet obstructing.

By the above description it is clearly shown that the two tumors are metastatic carcinomata of the choroid; also the history of the case, especially the rapid growth and the pain, would indicate it. Sarcomata of the choroid—only such could come into question—grow slowly and very rarely cause such intense pain. The small tumor being cut into sections, from one end to the other the larger one examined in various regions and directions, showed everywhere the same definite picture.

The just-described case is very similar to the second of Professor Hirschberg, with this difference, however, that it broke through the sclera. Common to all the cases is the flat expansion of the pseudoplasm, their width always considerably exceeding their height.

THREE CASES OF BONY ORBITAL TUMORS.

By Prof. ADAMÜK of Kasan.

Translated by Dr. W. F. Smith, Chicago, Ill.[1]

In Nos. 1 and 2 of vol. xx. of these ARCHIVES, appeared an article by W. F. Smith, entited "Case of Diffuse Hyperostosis of the Greater Wing of the Sphenoid—Right Side." In concluding this article the author states his deductions as to the etiology of the neoplasms in question, and in consideration of the materials at present available, he arrives at the following conclusion as to the character of bony neoplasms of the orbit: "Osseous tumors of the orbit, therefore, naturally divide themselves into two classes by the following points of difference: 1st, exostoses and hyperostoses originate from injury of periosteum or bone; and 2d, encapsulated osteomas have a fœtal origin and appear with the development of the bone cavities or sinuses, not later than the thirtieth year; whereby the last-named tumors constitute, as the author declares, the so-called *ossa eburnea*, viz.: are ivory-hard and enveloped by mucous membrane, while the first consist of true bone and appear to be covered with periosteum. "These well defined characteristics," Smith continues, "seem to make the two classes of orbital tumors sufficiently distinct," etc.

Now whether the deduced conclusions are absolutely correct or not can only be determined, in my opinion, by a large number of observations. From the fact that such cases are met with so rarely that the number at present reported does not exceed ten, the following account of

[1] From vol. xxi., No. 3, Germ. ed., 1890.

three cases of neoplasms of this kind, selected from among my own observations, will be of interest, especially as they seem to be partly in accordance with and partly against the conclusions of W. F. Smith.

The FIRST of these cases concerns a twenty-two-year old young man who came under my observation in 1870, almost twenty years ago. The patient, who had journeyed from Astrachan, presented, on his reception to our clinic, a remarkable abnormality of his right eye, which was strongly crowded forwards and at the same time seemed dislocated outwards.

The upper lid, though it appeared somewhat tense, failed to cover the bulb. On palpation we felt an uneven, immovable, hard tumor on the upper orbital wall filling almost two thirds of the orbit, movements of the globe normal, pupil responsive, S= 0.5, venous congestion of the retina. The hard tumor, which the patient had felt in the inner-upper corner of the orbit, had grown more rapidly during the last two years. In view of the extreme hardness of the neoplasm and its intimate connection with the bony wall of the orbit it was not difficult to diagnose an exostosis of the upper orbital wall. In consideration of the fact that the vision of the affected eye was still good and that the latter could not fail to be affected by the continued irritation due to the decided dislocation; further, in accordance with the pressing desire of the patient, I determined to remove the neoplasm by an operation. The nodulated form of the tumor, which seemed to indicate a certain isolated condition of the same, as well as the youth of the patient, gave hopes that I should meet with no particular difficulty in the operation, as I had lately seen a similar case in Paris, where the removal of such a tumor, from a nineteen-year old patient, had been successfully and easily accomplished by Professor Richet, after simply cutting through the soft parts with a pair of bone forceps. It resulted quite otherwise. After anæsthesia by chloroform had been secured an incision was made along the shaved eyebrow and was continued deep enough to expose the neoplasm. Separating the surrounding soft tissues I seized the tumor with the bone forceps, after the example of Richet, and tried to loosen it from its location. But this proved quite impracticable; for while the assistants held the patient's head so firmly as to prevent any rotation, the tumor remained absolutely immovable. Under these circumstances the contem-

plated removal of the tumor was only possible by means of the bone saw. At first we used the cock's-comb saw, but to reach the deeper parts other apparatus was found necessary. In this the best service was rendered by the Heine osteotome, by the aid of which we finally succeeded in reaching the deeper parts of the neoplasm. This required two hours of work, during which two osteotomes were broken, so dense was the bone sawed through. On account of the depth of the posterior surface of the tumor it could not be reached by the saw, and the remaining part had to be broken with the bone forceps. The neoplasm showed ivory hardness such that no chisel could make an impression on it. The neoplasm measured 39 *mm* by 35 *mm* by 19 *mm*, and weighed 23 *grm.*

After the operation the healing was prompt and normal in its course. The lips of the wound, united by sutures, closed for the most part, per primam. The bulb assumed its original, normal position and retained its functions perfectly. By the end of four weeks there remained only a small opening in the wound leading to the sawed surface, a slight ptosis and a certain obstruction to upward movement. The ophthalmoscopic appearances were entirely normal. In this condition, the patient returned to his home. His later history remains unknown to us.

From the above data it follows that, in this case, we have to do with a neoplasm of fœtal origin, the point of origin of which was to be found in the neighborhood of the frontal sinus, and which therefore may be considered a so-called encapsulated osteoma. To what extent it was covered with mucous membrane rather than with periosteum I cannot say. I remember, however, very well that sawing through the neoplasm was preceded by the tearing of an enveloping membrane. Concerning the character of this latter I can say nothing since it was allowed to remain *in situ*. Undoubtedly, however, it could not have been considered an isolated or encapsulated tumor; on the contrary, the osteoma was intimately connected with, and formed a part of, the neighboring bone. It is worthy of remark that the ablation of the neoplasm was successful, in spite of the anatomical construction being so very unfavorable to operative methods for its removal.

The SECOND of my observations concerned a bony, orbital tumor in a man thirty years of age. This case came into our clinic two years after the first. The tumor was much smaller, not larger than a hazel-nut, was situated in the upper and inner angle of the orbit, and its true character manifested by its complete immobility and remarkable hardness. The patient stated that two years before he had first noticed something uneven in the angle of the eye, and that the tumor had gradually increased in size since then. There had been no pain. The patient could assign no cause. Syphilis was not present. The eye was only slightly dislocated. The most remarkable symptom, however, consisted in a decided ptosis, as well as an almost complete lack of movement of the bulb upwards, whilst all other functions of the N. oculomotorius were unaffected. The further history of this case is unknown, as the patient absolutely refused to submit to an operation.

After some time I had the opportunity of observing a THIRD case of orbital osteoma, which occurred in a man thirty-five years of age and which had already reached considerable dimensions. On his entrance we found a large and painful swelling, and an ectropium of the eyelids, between which a pus-covered mass, the remnants of the eyeball, came to view. Upon explaining to the patient that he could expect no relief from pain except by an operation, he assented ; chloroform was administered, and the remnants of the bulb were removed. Continuing the anæsthesia, I proceeded to examine the orbital cavity, and it was not difficult to determine that almost the entire orbit was occupied by a tumor, extending from the upper orbital wall downward, and leaving a slit, only a few millimetres in width, between the tumor and the lower wall of the orbit. This narrow slit gave exit to the compressed optic nerve and the ocular muscles. Since nothing could be gained by the removal of the tumor, I determined to leave the parts as they were, and accordingly closed the wound by a tarsoraphy. The union of the lids was completed by normal processes, and in place of the unsightly mass that existed before there now remained an even surface of cuticle slightly elevated above the surrounding parts, but not at all sensitive to pressure, and the patient was dismissed in good condition at the end of four weeks.

In connection with the diagnosis of orbital osteoma the statements of the patient acquired a particular signification. When relieved of his pain by means of the operation, he informed us

that he had remarked the development of a bony protuberance at the inner angle of the eye ten years before, without there having been any visible cause, such as a wound, or the like. For some time the vision was unaffected. With the development of the tumor the eye was forced out of the orbit, although he could still see. There was great lachrymation, and the eye became red and painful. Finally the eye became opaque, and panophthalmitis ensued. From this time it is evident that, in the beginning, an ordinary exostosis of a fœtal origin had developed.

We have, therefore, before us a case of exostosis, undoubtedly of fœtal origin, but which did not present itself as an entirely isolated or encapsulated tumor, but, on the contrary, as an ivory-hard, indurated tumor, which invaded the entire upper orbital wall. One thing common to all these cases is undoubtedly correct—that is, the development of the neoplasm took place before the thirtieth year; further, the absence of any possible traumatism, and finally, the undoubtedly early eburneation of the respective osteoma.

In publishing these observations I had only in mind to increase the fund of information regarding these rare cases, with no idea of refuting the conclusions of W. F. Smith.

Since 1878 I have not met with a single additional case of bony orbital tumor, although during this last decade I have examined over twenty-five thousand patients.

A CASE OF LEUCOSARCOMA OF THE IRIS WITH IRITIS SEROSA.

By Dr. PH. LIMBOURG,

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(*With a lithographic plate—tab. xvi. of vol. xxi., German edition.*)

Translated by Charles H. May, M.D., New York.

NON-PIGMENTED sarcomata of the iris are very rare. In the well-known monograph of Fuchs[1] only three cases are mentioned (Lebrun, Dreschfeld, Knapp), and these are contrasted with thirteen cases of melanosarcoma. Subsequently leucosarcomata were described by Sauer[2] and by Zellweger.[3] Melanosarcomata, on the other hand, have been reported so frequently that the ratio expressed by Fuchs has been preserved. Another case of leucosarcoma was observed in Prof. Laqueur's clinic; this case was peculiar in having serous iritis associated with it:

A girl, seven and one half years old, was admitted to the clinic on account of partial loss of sight in the left eye, which had lasted three weeks. Examination showed the following: Vision in the affected eye decreased to the perception of fingers at one metre. Slight episcleral injection. Numerous fine deposits on the posterior surface of the cornea. Anterior chamber increased in depth. A new growth of yellowish color and smooth surface occupied the entire upper and inner quadrant of the iris and extended to the cornea. With the lens, tortuous vessels are seen at the upper margin of the tumor. Tension of the eyeball some-

[1] "Das Sarcom des Uvealtractus," Wien, 1882.
[2] Inaug. Dissert., Halle, 1883.
[3] *Klin. Monatsbl. f. Augenheilk.*, 1888, Bd. xxvi., S. 366.

what increased ($+T_1$). The pupil was irregular; after instillation of atropine, it enlarged and became obliquely oval. The deeper portions of the eye could not be examined. Right eye normal, excepting old opacities.

As there was no reason to suspect syphilis, the diagnosis lay between solitary tubercle and sarcoma. The family history supported the diagnosis of tubercular new growth. The father and two older children had died from tuberculosis; the patient was a delicate, scrofulous girl who had had rhachitis for a long time. This diagnosis received additional support from the absence of pigmentation—for sarcomata of the uveal tract are usually melanotic. The occurrence and the rapidity of growth of the tumor could not be ascertained on account of the youth of the patient. The fact of the tumor having been observed only two weeks could be attributed to the occurrence of serous iritis, since occasionally diseased or weakened eyes become "infected." Neither was the age of the patient decisive, for sarcomata are also observed in young persons. Against the diagnosis of tuberculosis were the dilatation of the pupils after atropine and the absence of posterior synechiæ.

Iridectomy, recommended by Graefe[1] and Mooren,[2] and which has been done successfully in a number of cases of tumors of the iris which were well circumscribed, was not considered in this case, on account of the size of the tumor and the inflammatory manifestations; the eye was enucleated by Prof. Laqueur.

The eyeball was then examined, an incision being made through the centre of the tumor. The latter measured 5 *mm* in its longest diameter and 1.5 *mm* in thickness. The incision showed it to be of an almost pure white color, and it seemed limited to the iris. Anteriorly it extended to the cornea, with which, possibly, it had become loosely adherent in the angle. The divided eyeball was hardened in Müller's fluid and in alcohol.

Upon microscopical examination, Professor v. Recklinghausen pronounced the tumor a *non-pigmented sarcoma*, formed of spindle-cells, between which were a few small round-cells; there was a small amount of intercellular fibrous tissue; there were few blood-vessels. Fatty degeneration in many portions of the tumor (Fig. 1, *a*). The anterior and posterior surfaces were bounded by pigmented iris-tissue. The new growth extended farther than was

[1] *Arch. f. Ophth.*, 1861, Bd. viii., 1, S. 288.
[2] "Ophthalmiatrische Beobachtungen," Berlin, 1867, S. 127.

apparent on microscopical examination; it involved the adjoining portions of the ciliary body, extending to the commencement of the ciliary muscle, and encircled the canal of Schlemm. The greater portion of the iris, which seemed normal, was also found to contain numerous areas; thus masses of the tumor were found extending somewhat into the pupil and arising from the opposite side of the pupillary margin from the main portion of the new growth and at the anterior surface of the iris (Fig. 1, *b*). These masses were very limited in certain sections, but in others they revealed a direct connection with growths which had caused extensive destruction of the pigment layer in the posterior portion of the iris (Fig. 1, *c*). Sarcomatous masses, which projected considerably into the lower iris angle, were especially extensive (Fig. 1, *d*). Whilst the eyeball was *in situ*, these masses were not visible—partly because they were hidden by deposits upon the cornea and partly because the observation of this portion of the anterior chamber is difficult in itself. In making sections of the globe imbedded in celloidin, this projection gave rise to the impression of being due to the serous iritis, and possibly consisting of a loosened collection of corneal deposits. Upon microscopical examination, this mass, the transverse section of which was round, presented the structure of a new growth. Here and there it appeared only slightly adherent to the iris; but often sarcomatous masses extended from it deeply into the iris and ciliary body. Of the latter the connective-tissue boundary layer exclusively and the ciliary processes were involved. Sarcomatous areas could be demonstrated extending to the centre of the iris (Fig. 1, *e*). The *pars ciliaris retinæ* was destroyed by it in many places. The ciliary muscle was entirely free from involvement.

Thus an extensive infiltration of the rest of the iris had proceeded from the lateral portions of the main part of the tumor. Possibly, certain areas were produced by the separation of small particles from the surface of the tumor, and their subsequent deposition upon different portions of the iris by the aqueous humor.

Cases have been described in which there was partial atrophy of the lens, at times without any change of position, from pressure of slowly growing sarcomata of the iris (Hirschberg, Schiess-Gemuseus) and of the ciliary body.[1] In our case also, several shallow depressions on the anterior surface of the lens could be demonstrated (Fig. 2); at these spots, the capsule and epithelium

[1] Fuchs, *l. c.*, S. 216 u. 217.

showed no appreciable changes. There were occasional adhesions between the lens and the posterior surface of the iris, opposite sarcomatous areas.

Our case was of special interest, on account of the existence of serous iritis. Up to the present time Schweigger[1] and Knies[2] have been the only ones to investigate this morbid process anatomically. The changes which I found showed some differences, probably referable to the fact that I was privileged to observe a pretty early stage.

The interlamellar spaces of the cornea were wide and abundantly supplied with cells; but this might vary within normal relations. The form of deposits upon the posterior surface of the cornea was irregular; but in general two varieties could be distinguished. Besides a low, pretty even deposit, there were the well-known larger masses, easily seen microscopically, which are considered especially characteristic in serous iritis (Fig. 3). As already mentioned by Schweigger and Knies, the endothelium of Descemet's membrane had disappeared in part, beneath the deposit. A relationship between the endothelium and the form of deposit could not be demonstrated, although it seemed probable that such a relationship existed. The deposit had the usual composition of detritus and nuclei. Occasionally endothelial cells were seen surrounded by cell-fragments. The deposits were almost completely devoid of pigment; the origin of the slight pigmentation will be referred to again.

The meshes of the ligamentum pectinatum were found enlarged and completely filled with round-cells; this collection of cells extended to Schlemm's canal.

The portion of the iris which was not attacked by the new growth presented an abundant infiltration with round-cells; this infiltration differed from that described by Knies in that I could not find larger collections of round-cells anywhere, and, above all, I could not demonstrate the existence of any arrangement resembling a lymphoma. It extended pretty evenly through the entire stroma, and could be followed

[1] "Handbuch der Augenheilk.," 5 Aufl., 1885, S. 333.
[2] *Arch. f. Augenheilk.*, Bd. ix., S. 1.

into the depressions of the anterior surface of the iris, down to a deposit found here (Fig. 1, *f.*) resembling that on Descemet's membrane, except that there was less structural degeneration. The deposit found over many portions of the surface of the large tumor of the iris was found to consist partly of tumor cells and partly of the products of serous iritis. Excepting destruction produced by the new growth, the pigment layer of the iris was unchanged.

The ciliary body also presented marked cellular infiltration, resembling that described in connection with the iris and like that demonstrated by Knies. In the boundary layer it was difficult to separate tumor from infiltration. The pigment cells of the *pars ciliaris retinæ* were very light in color and deficient in pigment.

The zonula also presented numerous round-cells and pigment-nuclei.

The choroid was apparently normal; the number of round-cells which it contained was probably not increased or only to an insignificant degree.

In addition, there were also deposits on the anterior capsule of the lens, chiefly insignificant in amount; these were found especially in the pupillary area and in the atrophic portions already described. They differ from the deposits on the posterior surface of the cornea and on the anterior surface of the iris in presenting considerable pigmentation; this originated principally in the sarcomatous masses on the posterior surface of the iris and the ciliary body.

Reviewing the important points, our case was one of leucosarcoma of slow growth, occurring in a child, and observed at the beginning of the inflammatory period.[1] The growth had remained unobserved for a long time, since its development had been a slow one, and since the pupil had remained free, and the lens had not become displaced, or at least had not become changed in shape in its central portion. It was not until the occurrence of deposits upon the posterior surface of the cornea and the anterior surface of the lens that the attention of the child and others was directed

[1] H. Knapp, "Die Intraoculutaren Geschwülste," Karlsruhe, 1868, S. 178.

to the growth, which anatomical investigation showed to be of much longer duration. We cannot even tell approximately what the duration of the first stage was. The increase in tension is easily explained by the partial obstruction of the canal of Schlemm by the tumor.

The iridocyclitis serosa, an anatomical examination of which was possible two weeks after its commencement, resulted in a uniform infiltration of the iris and ciliary body. The round-cells escaped from the anterior surface of the iris into the aqueous and formed deposits upon the iris, or were washed against the posterior surface of the cornea forming diffuse or greater and more circumscribed deposits, as a result of which the endothelium of Descemet's membrane was the seat of considerable disturbance. Most of the cells were removed by Fontana's spaces. Pigment was very scanty and in most places it seemed to be due to accidental additions from the new growth.

In conclusion I wish to express my sincere thanks to Prof. Laqueur and Prof. Recklinghausen, for their kind assistance.

NODULAR OPACITIES OF THE CORNEA (NODULI CORNEÆ).

By Dr. A. GROENOW,

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Translated by Dr. J. M. Mills, New York.

(*With a drawing in the text.*)

THE name keratitis punctata is used for the different forms of punctate and nodular opacities of the cornea, whether they are stationary or the manifestation of a recent keratitis. Nearly every author gives it a different construction.

As regards the stationary punctate form of corneal opacities, Graefe [1] incidentally mentions a case which later on will be more minutely considered.

Heymann [2] describes the linear corneal opacities, in which he includes the well-known striped keratitis found after cataract operations, and Raehlmann [3] describes, in detail, similar linear and striped forms of opacities, which sometimes acquire a distant resemblance to the dots or nodules when the thickness produced by the intersection of the different striæ gives the impression of a special formation. He also mentions the punctate opacities which lie in the deeper layers of the centre of the cornea, and which later, through confluence, form opacities, as are often found in the course of a diffuse parenchymatous keratitis; the cornea is generally slightly vascular, iritis is absent. These opacities

[1] *Arch. f. Ophthal.*, Bd. ii., 2, S. 309.
[2] *Klin. Monatsbl. f. Augenheilk.*, Bd. vi., S. 277.
[3] *Klin. Monatsbl. f. Augenheilk.*, Bd. xv., S. 1.

have nothing in common with the punctate precipitate on the posterior corneal wall observed in iritis serosa.

A true punctate keratitis, dependent upon a syphilitic basis, is described by Mauthner.[1] This form is characterized by circumscribed small gray spots in the substantia propria corneæ and in fact in the various layers. The corneal tissue surrounding the focus is only slightly altered. Peri-corneal injection may be absent. The central deposits never attain a larger extension or form an abscess; they can develop quickly and disappear rapidly, leaving no opacities or only the punctate form.

The iris does not participate in this process. This rare disease occurs only in general syphilis, the isolated spots in the cornea are probably small gummata.

Hock and Purtscher[2] have observed a similar disease; the latter reports a case which was complicated with iritis, opacities of the vitreous, and retinitis. He obtained a cure with mercurial inunctions and potassium iodide, as the patient had inherited syphilis.

Schweigger[3] considers the punctate keratitis to be a hybrid variety of the deep corneal inflammation, which is usually complicated with iritis and heals in from two to three months without leaving any traces; it is not infrequently of a syphilitic origin.

Lately Adler[4] has described a disease under the name "keratitis subepithelialis centralis," which Fuchs[5] terms "keratitis superficialis punctata." This disease, according to the reports of both authors, which agree in almost every particular, begins with the symptoms of an acute conjunctivitis with profuse lachrymation, and then, after from eight to twelve days, the changes in the cornea appear, whilst the conjunctival catarrh quickly disappears, and the eye from then on remains unirritated. The corneal opacities consist

[1] Zeissl's "Lehrbuch der Syphilis," 5 Aufl., 1888, S. 633.
[2] Un caso di cheratite punctata albescens. *Boll. d'Ocul.*, Bd. vi., No. 11, S. 237.
[3] "Handbuch der Augenheilk.," Berlin, 1880, S. 314.
[4] *Centrabl. f. prakt. Augenheilk.*, 1889. S. 289.
[5] "Lehrbuch der Augenheilk.," Leipzig u. Wien, 1889, S. 189 f. *Wiener klinische Wochenschr.*, 1889, No. 44.

of small gray disc-shaped spots, scarcely ¼ *mm* in diameter, and of a yellowish-white or gray color; their number varies between ten and one hundred, and they occupy exclusively or principally, at least, the central portion of the cornea, directly under the epithelium or even in the propria. The corneal tissue between them is transparent and shows, sometimes, small, somewhat deeper lying dots. With a strong magnifying glass, the larger spots resolve themselves also into a large number of exceedingly fine small dots. The epithelium does not, by any means, always project above the opacities and is never materially altered. The corneal affection is usually only unilateral, and rarely affects both eyes. The spots gradually fade, and disappear entirely in a few months, at the latest in a year. Complications with iritis or hypopyon have not been observed. This disease is closely allied to "herpes febrilis corneæ," however, it differs from it essentially in the absence of pustular formations on the cornea.

v. Reuss[1] has described the same disease by the name of "keratitis maculosa," but deviates from the description of the other two aforementioned investigators in several points. According to him the corneal spots have a diameter of 1 to 1½ *mm*, are not sharply circumscribed but are encircled by a blurred zone; they are most numerous at the periphery, although the centre is never entirely without them. Their course, according to Reuss, is also somewhat different, as the spots, even after remaining several months, seldom disappear entirely.

The picture, of the disease, as described by Adler and Fuchs, has a certain similarity with the "nodular form of corneal opacities," which, next in the succession of the cases observed, will be more minutely described.

T——, 49 years old, came to the policlinic on June 17, 1886, with a conjunctival catarrh of the left eye, with which he had been suffering eight days. Patient has not, to his knowledge, had any inflammation of the eye in the past few months or years; is likewise ignorant of any cause for his present condition. Careful examination revealed a large number, about fifty to sixty distinct gray opacites in both corneæ, situated close under the epithelium, which

[1] *Wien. klin. Wochensch.*, 1889, No. 34, P. 665.

in the left eye was somewhat elevated. These opacities occupy the central portion of the cornea, whilst the margin is entirely free; they are of a whitish-gray color and about the size of a millet seed. Later, upon a more exact examination, these spots were found to lie in the superficial (epithelial) layers of the cornea, perhaps in the foremost layer of the corneal tissue proper, whilst between them are scattered a large number of fine points, hardly half the size of the former. Otherwise the corneal tissue between the individual opacities is entirely clear. The individual dots are of a spherical form, sharply circumscribed, and never coalesce into larger spots, but, at the most, form, by juxtaposition, here and there groups of two or three parts. These nodules resemble, principally in size and form, the precipitate on Descemet's membrane in iritis serosa; however, are distinguished from these, apart from the entire absence of any symptoms of iritis, by their distinct subepithelial position, which is made especially manifest by the circumstance that they cause the corneal epithelium to protrude in parts.

The conjunctiva of the right eye of the patient was not at all injected, though in the left there was considerable catarrhal injection and a partial defect in the corneal epithelium over the opacities. The iris was entirely normal, also the opthalmoscopic condition, only that the fundus appeared considerably distorted, in consequence of the irregular curvature of the cornea. The treatment consisted, in the first place, in the application of a compressive bandage on the left eye, whilst a ½ % solution of zinc sulphate was instilled, twice daily, into the conjunctival sac of the right eye.

On June 22d the patient was admitted to the hospital, and four days later, after the injection had subsided, we proceeded to scrape off the corneal epithelium of the left eye, and then the opacities were found to be much firmer and more resistant than the epithelium, so that during the abrasion they produced the same sensation as of scraping a grater with a knife. The same operation was repeated, on July 2d, in the second eye, after a previous scarification. Each eye remained bandaged for three days after the scraping, and then a boric acid solution was instilled twice daily.

On July 13th both eyes were without irritation, and the epithelium restored though the opacities did not appear at all changed; at the most they were only somewhat smaller. The vision in each eye was $\frac{20}{100}$ Sn. Patient was discharged.

On Sept. 29th the patient came again to the clinic. Both eyes were slightly injected in the region of the palpebral fissure; the corneal opacities were entirely unchanged. Vision = $\frac{20}{100}$, which increased to $\frac{40}{100}$ in each eye, after a scraping of both corneæ, made the next day; however, the appearance of the opacities was not appreciably altered.

Four months later, on February 3, 1887, the patient was again admitted to the clinic. The opacities had increased somewhat on both sides, therefore an energetic scraping was again undertaken. After this the vision again increased to $\frac{40}{100}$, and the gray points in the cornea were not so numerous as before the operation. This same procedure was repeated on November 30th of the same year, and the eyes remained permanently without injection, but the opacities showed no perceptible change, and the vision remained $\frac{40}{100}$. The same condition was still present on May 25, 1889, when the patient appeared for the last time.

In this case the corneal opacities portrayed lasted three years entirely without change. Symptoms of irritation, worth mentioning, were only present in the left eye for the first two weeks, and they appeared to be due to an accidental excoriation of the cornea, as the other eye, affected with the same corneal opacities, was entirely without injection.

The second case, Johanna B——, æt. 17 years, visited the policlinic, for the first time, on July 7, 1887. She had noticed a gradual decrease in the sight for four years, without any symptoms of inflammation. The eyes were found to be without injection, and showed corneal opacities similar to those of the first-mentioned case. S = $\frac{20}{100}$ — 70 Sn. The treatment consisted of the instillation of a solution of zinc sulphate, beginning with one per cent. and increasing to four per cent.; however, without success.

On December 5th, of the same year, the patient was admitted to the clinic and the following condition noted: Conjunctiva of both eyes unirritated; in the centre of the cornea, covering a circular surface of 4 *mm* in diameter, and entirely absent in the periphery, were thirty gray, sharply defined, miliary opacities. They were round in form. They appeared as granules in the cornea, and, in fact, in the superficial, epithelial, or sub-epithelial layers; they projected somewhat above the cornea, which, consequently, appeared to be covered with little humps, still their surfaces were covered with epithelium. And when the cornea was examined with the keratoscope of Placido, the reflection of the

black concentric circles appeared, in certain places, as if it was interrupted by distinct interstices that correspond to the small protuberances. With the haploscopic magnifier very fine, dust-like opacities can be seen between the granules, though otherwise the corneal tissue is completely normal. See accompanying figure.

The latter are not shown in the adjacent schematic sketch, which is taken from the history of the case in question. The iris and fundus are normal; only the latter, on account of the corneal opacities, appears considerably veiled and astigmatically distorted. The vision, right, is $\frac{20}{100}$; left, $\frac{20}{200}$, which increased to $\frac{20}{10}$ after scraping the epithelium, though the opacities remained unchanged; at most, the individual nodules did not project so far above the corneal surface as before.

NODULAR FORM OF CORNEAL OPACITIES.

The microscopic examination of the scraped-off epithelium revealed no special histological elements which were characteristic of the opacities. The patient left the clinic on December 18th. She was advised to use, at home, a one-per-cent. solution of zinc sulphate as a mild irritant.

In April, 1888, the patient appeared again at the clinic. The vision was the same as in December, namely, $\frac{20}{70}$ in each eye; the corneal opacities were unaltered. As it is alleged that nævi and corneal leucomas can be removed by the electrolytic treatment, it was attempted with the constant current. The left eye was thoroughly cocainized, and then a small moistened sponge-electrode (kathode) placed on the cornea, whilst the anode lay upon the neck, and then the current up to four elements of a Voltolini dip-battery, gradually slipping in and out, was sent through the eye. For comparison, the right eye was only treated with a twenty-per-cent. zinc solution. After about fifteen sessions up to May 11th, the corneal opacities and vision were absolutely unimproved, quite the reverse, in fact, as a small excoriation of the left cornea was produced by the electricity, necessitating a cessation of the electric treatment for several days. The patient has not appeared since.

Also in this case the corneal opacities remained a year entirely unaltered; very likely, however, they were present four years previous to the beginning of observation.

Reviewing the described picture of the disease it is as follows: With the exception of what was probably an accessory unilateral conjunctival catarrh, in the first case, there was no injection of the conjunctiva of any consequence, nor a vascularization of the cornea, nor an iritic irritation; so that during the whole period of observation it was not a question of a florid process, as a keratitis, but rather a condition of stationary nodular opacities of the cornea. The opacities consisted of sharply outlined gray dots that did not exceed $\frac{1}{4}$ *mm* in diameter and were thickly scattered, did not become confluent, were separated from one another by healthy corneal tissue, entirely free from spots or stripes, only that between these larger opacities lay smaller, almost dust-like, gray dots, which though half as large were more numerous. The opacities occupied almost exclusively the central portion of the cornea and were situated in the superficial layers, but not only in the epithelial layer, which perhaps was affected by them. The larger ones formed small protuberances on the surface of the cornea and disturbed the vision very much, though otherwise the surface of the cornea was smooth; defects of epithelium do not belong to the picture of the disease. At the scraping, the opaque places were found to be firmer and more resistant than the epithelium. They most likely develop very slowly, seem not to overstep a certain limit, and never retrograde spontaneously, at least they remain stationary for years. All treatment is comparatively powerelss; the scraping off of the epithelium produces occasionally, for a short time, a certain amount of improvement of the sight; less successful are the irritant remedies—for example, two to four-per-cent.-zinc solutions; the electric treatment is useless. The name "nodular corneal opacities (noduli corneæ)" appears suitable to characterize the described opacities.

That these opacities originated from an acute keratitis, as perhaps the subepithelial inflammation of Adler, is very doubtful, as only the first patient at the time he appeared for treatment had, for eight days, an irritable condition of one eye. Therefore the opacities must have originated, quite acutely, in the course of a week, which is hardly credible,

considering the resistant nature that characterizes them as epithelial or connective-tissue proliferations, not as infiltrations; the supposition is much more justified that the not over-intelligent patient had completely overlooked, as long as he had no pain, the disturbance of sight occasioned by the gradual formation of the opacities (probably continuing through several years), and only sought medical advice when it was accidentally complicated with an acute conjunctival catarrh of one eye.

This is justified by the circumstance that the opacities after three years presented exactly the same appearance as at the stated beginning of the disease. The second patient had no inflammation of the eye at all and only came to the policlinic for treatment on account of the defective sight, produced by the opacities, which was of four years' standing.

The nodular forms of corneal opacities are therefore not a product of an acute keratitis, but rather develop gradually and chronically, without any symptoms of inflammation, and notwithstanding that they continued unchanged for several years, never produced any irritation in the eye. They are most likely, as in the case of Graefe, to be mentioned later, epithelial proliferations, or perhaps also cicatricial tissue. According to the opinion of Professor Förster, with whom the designation "nodular opacities of the cornea" originated, they resemble mostly the moderately prominent corneal spots that are occasionally found in otherwise perfectly healthy corneæ, and which we are inclined to consider proliferating cicatrices, in which at best there is no proof of a previous ulcer.

Of the cases mentioned in the literature, that of v. Graefe (*l. c.*) bears a close resemblance to the described disease.

A patient had acquired an opacity of the cornea of the right eye from an injury produced by a child's finger-nail. A large number of exceedingly fine yellow dots were scattered over the surface of the cornea, between which there were entirely regular transparent spaces. They only occupied the centre of the cornea and were situated directly under Bowman's membrane, or even more externally. As the opacities

caused quite a considerable defect of sight Graefe decided to remove them. He succeeded, contrary to his expectations, in easily removing, with the forceps, the entire part of Bowman's membrane containing the dotted opacities. The examination showed that the opacities were situated on the external surface of Bowman's membrane—that is, in the epithelial layer; they formed concentric stratified epithelial globules, whilst the membrane itself exhibited no changes.

These punctate opacities do not entirely accord with those described, as, in the first place, the opacities were the result of a trauma; furthermore, were yellow not gray; and lastly, could be completely detached, together with Bowman's membrane; still, otherwise they possess a great similarity with the "nodular opacities," as also in this case stationary punctate opacities in the epithelial layer of the cornea were present.

Of the other forms of keratitis punctata Mauthner's syphilitic form cannot at all be taken into consideration, nor indeed the linear and striped opacities of Heymann and Raehlmann, whereas the keratitis subepithelialis, according to the description of Fuchs and Adler, as regards the appearance of the opacities, almost completely coincides with the opacities of the cornea just described; it is true only macroscopically, as with the magnifying glass the nodular opacities of the cornea appear as solid structures, whilst the spots of the subepithelial keratitis appear as densely crowded small points.

The important difference, however, to be noticed between the two diseases is, that in the cases in question most assuredly we had not to deal with a cellular infiltration resulting from an acute keratitis. For there could only have been semi-fluid or cellular masses of exudation, which appear, in the course of two to three weeks, in subepithelial corneal inflammation, and then, even though it is after a lapse of months, become smaller, and finally disappear entirely; whilst, on the contrary, the nodular opacities of the cornea constitute small round solid formations, which develop slowly, remain stationary for years, and are much harder than the corneal epithelium, therefore must consist of epithelial proliferations or

cicatricial tissue; whilst cellular infiltrations are softer than the corneal epithelium and, in any case, cannot remain unchanged for years.

Consequently the nodular opacities of the cornea are to be considered a special form of stationary corneal opacities, which, to a certain extent, belong in the same group with the so-called ribbon keratitis. We are not justified in regarding it as a chronic form of the keratitis subepithelialis, or as a sequel of this disease, that, as yet, has not been observed.

NOTES ON BIFOCAL LENSES.

By ARCHIBALD PERCIVAL, M.A., M.B., Camb.,
Newcastle-upon-Tyne.

(*With four figures.*)

I READ with great interest the account of Dr. Gould's improvement in bifocal lenses, which appeared in the December number of the ARCHIVES, as I had devised a very similar modification shortly before I saw his paper on the subject. It is possible that the following notes respecting the size, form, and position of the presbyopic segment may be of interest to some readers of the ARCHIVES.

The fixation field for near vision need not extend more than 14° on either side of the middle line, therefore the width of the presbyopic segment need not be greater than 2 (k tan 14), where k is the distance of the first principal focus of the eye (*i.e.*, the position of the lens) from the centre of rotation of the globe, 27.4751 *mm.* This brings the width of the presbyopic glass to 13 or 14 *mm*, and is amply sufficient to allow the wearer to read comfortably without moving his head. In my pattern the upper limit of the glass forms a horizontal line as indicated in the sketch. It appears also advisable to decentre this small glass in such a manner that when combined with its larger fellow the optical centre of the two may be traversed by the visual lines in reading. If we assume that a downward rotation of the globes to the extent of 15° takes place in reading, the optical centre of the combination should be k tan 15° or 7.36 *mm* below the horizontal plane, *i.e.*, below the optical centre of the distance glass. Lastly, since a convergence of

3 m. a. occurs when the reading distance is $\frac{1}{3}$ metre, the optical centre of the reading combination should be displaced 2.5 *mm* inwards (if distance between ocular centres 64 *mm*, $\frac{27.475 \times 32}{333.\dot{3}+13.7} = 2.53$ *mm*).

Now the deviation of a ray which traverses a point V millimetres below the optical centre of the large (distance) lens is $\tan^{-1}\frac{V}{F_1}$, where F_1 is the focal distance of the lens, or $\tan^{-1}\frac{V D_1}{1000}$, where D_1 represents its strength in dioptries. This vertical deviation must be corrected. [1] Let *a* be the

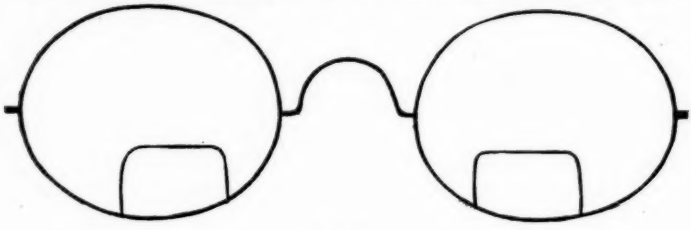

FIG. I.

constant representing the displacement downwards of the geometrical centre of the small lens below the optical centre of the reading combination. Then $\tan^{-1}\frac{a D_2}{1000}$ tends to compensate the primary deviation, where D_2 represents the dioptric strength of the small glass, and $\tan^{-1}\frac{V D_1}{1000} - \tan^{-1}\frac{a D_2}{1000}$ is the deviating angle of the prism required to give the requisite vertical focus of the optical centre of the combination. Similarly the prism for the horizontal correction (H) is given by the formula $\tan^{-1}\frac{H D_1}{1000}$. The small prismatic lens (D_2) is cemented to the distance lens in the normal position, *i.e.*, H *mm* inwards, so that the full value of the binocular fixation field at reading distance is obtained, and when the visual lines are parallel symmetrical retinal

[1] If h_1, h_2 represent the heights of the two lenses in millimetres $a = \frac{h_1 - h_2}{2} - V$. With the dimensions subsequently given $a = \frac{30-12}{2} - 7$, or 2 *mm*.

areas are no longer completely covered, hence nearly central (distance) vision may be obtained by one or the other eye.

To take an example: suppose glasses of this kind are to be ordered for a presbyopic hypermetrope H = 2 D, Presb = 3 D. Elliptical plano-convex lenses + 2 D of the usual size, 30 *mm* × 36 *mm* are mounted in the ordinary manner. Prisms are now taken which will compensate for both the horizontal and vertical deviation, their dimensions being 12 *mm* × 14 *mm*. Let φ denote the deviating angle of the prism required for the vertical correction

$$\varphi = \tan^{-1}\frac{V\,D_1}{1000} - \tan^{-1}\frac{a\,D_2}{1000} = \tan^{-1}\frac{7.36\times 2}{1000} - \tan^{-1}\frac{2\times 3}{1000}$$

$$= \tan^{-1}.01472 - \tan^{-1}.006 \quad = 50'\ 36'' - 20'\ 38'',\ i.e.\ 29'\ 58''$$

Let θ denote the prism required for the horizontal adjustment:

$$\theta = \tan^{-1}\frac{H\,D_1}{1000} = \tan^{-1}\frac{2.53\times 2}{1000} = \tan^{-1}.00506 = 17'\ 3''$$

If α be the deviating angle of the resultant prism:[1]

$$\sin\alpha = \sqrt{\sin^2\varphi + \sin^2\theta} = \sqrt{\sin^2 29'\ 58'' + \sin^2 17'\ 3''}$$

$$\therefore \alpha = 34'\ 33''$$

If ρ be the angle of rotation of this prism from the vertical

$$\sin\rho = \frac{\sin\theta}{\sin\alpha} = \frac{\sin 17'\ 3''}{\sin 34'\ 33''}$$

$$\therefore \rho = 29^\circ\ 39'$$

Prisms therefore of deviating angles 34′ 33″ are required set with apices obliquely upward and inward at an angle of 29° 39′ from the vertical of dimensions 12 *mm* × 14 *mm*, and ground convex on one surface to the extent of + 3 D. These are cemented 2.53 *mm* to the nasal sides of the distance lenses. In cases of heterophoria the appropriate prismatic correction can be easily introduced into the calculation.

In the case of presbyopic myopes the base of the correcting prism would be upward, and hence the process known as double-grinding gives more satisfactory and certainly more

[1] Mr. Ernest Maddox gives these formulæ for resultant prisms in his useful book on the "Clinical Use of Prisms."

graceful results, though there are some attendant disadvantages. In these cases the lower segment forms a meniscus, the optical centre of which lies outside the glass. The vertical upward deviation due to the plano-concave, when the visual lines traverse points V millimetres below the centre of the lens, is $\tan^{-1}\frac{V D_1}{1000}$; the vertical downward deviation due to the convex segment is $\tan^{-1}\frac{V D_2}{1000}$. A prism whose deviating angle is $\tan^{-1}\frac{V D_1}{1000} - \tan^{-1}\frac{V D_2}{1000}$ is cemented on to the plane surface of the plano-concave apex downward, and its free surface then ground to a convexity of + 3 D until the tool has traced out a convex surface reaching to a point about 3 *mm* below the geometrical centre of the large lens. The prism which was used for blocking out the upper segment is then detached, and a lens is formed as in the

FIG. 2.

FIG. 3.

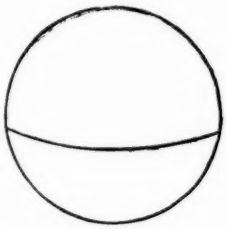

FIG. 4.

annexed diagrams, Figs. 1, 2, 3, 4. To take an example, let $D_1 = -7$, $D_2 = +3$, $V = 7$ *mm*. A plano-concave of − 7 D is taken, to this is cemented a prism whose deviating angle is $\tan^{-1}\frac{7\times 7}{1000} - \tan^{-1}\frac{7\times 3}{1000} = 2^\circ\ 48'\ 20'' - 1^\circ\ 12'\ 20''$ or 1° 36′. This is ground by a 3 D tool in the manner above explained. Unfortunately it is a mechanical impossibility for the tool to trace out a convex surface bounded by a convex margin. It is usually unnecessary to correct

the horizontal deviation, as there is frequently slight exophoria in accommodation in high myopia, which a glass of this pattern tends to relieve. Should, however, a correction be necessary, the prism is increased to the requisite degree and the lens rotated to the appropriate position when mounted in the frame. The formulæ for this calculation are given above.

The cost of spectacles made in this way has prevented my ordering them as frequently as I could have wished, but those who have worn them speak of them with the highest praise. I can fully endorse all that Dr. Gould says with reference to his modification, but would add that they are not suitable for astigmatic patients.

It may seem that the formulæ given for prescribing these spectacles are needlessly complex, but it must be remembered that they are designed for those who are doomed to wear glasses always, and a little extra trouble can be well spared in their behalf.[1]

[1] Messrs. Curry & Paxton, Gt. Portland Street, London, have most skilfully and successfully worked out my designs.

SKIASCOPY: WITH A DESCRIPTION OF AN APPARATUS FOR ITS READY EMPLOYMENT.

By SWAN M. BURNETT, M.D.,

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(*With a wood engraving.*)

SKIASCOPY has now a recognized place among the scientific methods of testing the refraction of the eye, and its employment, while perhaps not general, is increasing in extent. The principles on which it is based are now explained (though not in every case fully or accurately) in several recent text-books on the eye, and in most of the manuals on refraction,[1] so that it is not necessary to consider here the theoretical part of the subject.

While deeming it one of our most valuable means of determining refraction, I still do not hold it superior to all others for all sorts of cases. It has its limits as well as its advantages. Thus, I think that the accommodation of the patient comes in to vitiate the result to a much greater extent than in the direct ophthalmoscopic method. But for children and high degrees of ametropia it is the easiest of any of the methods at present in use, and is as scientifically accurate as any. And, as I have elsewhere[2] remarked, we cannot have at our hands too many means of verifying our diagnosis in refraction.

But while there are few who doubt the scientific ac-

[1] See paper, by the author, on "Skiascopy," in *Medical News*, Sept. 15, 1888.
[2] Theoretical and Practical Treatise on Astigmatism. Chambers, St. Louis, 1887.

Fig.1.

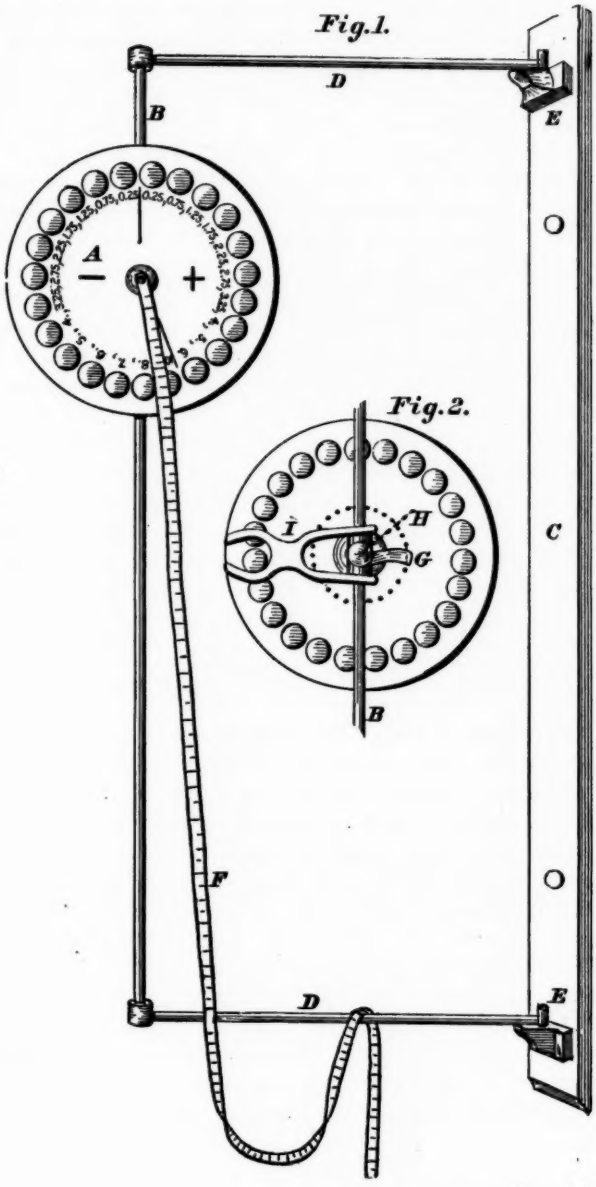

Fig.2.

curacy of the method, a large number are no doubt debarred from its use by the lack of an easy method of employing it.

In using it in the manner most generally employed, it is necessary to fit a trial frame before the eye, and place lenses therein in succession until one is found which gives emmetropic movements to the shadow. This, however, is so consumptive of time and patience that the surgeon in the hurry of practice is likely to select some other and shorter method. It was for the purpose of facilitating this examination that I devised the simple apparatus described below, and which I exhibited first at the meeting of the American Ophthalmological Society, at Washington, in 1888. I have been using it since that time in my daily practice to my own complete satisfaction, and I have no hesitation in recommending it to the profession for the purposes intended. It consists of a hard-rubber disk, *A*, Fig. 1 (Fig. 2 being a back view), containing 23 lenses on its periphery—10 convex and 13 concave. This disk is movable on the brass-rod *B*, which is attached at either end to two other bass rods, *D D*, which turn on the pivots *E E* fastened to the wooden board *C*, which is attached to the wall of the ophthalmoscopic room. This enables the disk to be placed, by means of the screw *H*, Fig. 2, at any height, and to be turned and retained in any desired position, and the whole apparatus can be turned back against the wall when not in use.

The patient is placed in a proper position near the ophthalmoscopic lamp, and the disk is brought before the eye to be examined. By turning the disk on its axis all the lenses can be brought in rapid succession in front of the eye, and the one giving emmetropic movements to the shadow soon found. The revolving of the disk can be done by the patient or by the surgeon himself, who can easily reach it by a step from his examination distance of one to one and a half-metres. Of course the disk can be made large enough to contain any number of lenses. But those I have used are, according to my experience, ample for all ordinary cases, and keep the size of the disk to easily manageable dimensions. When other and stronger lenses are required, a lens from the trial-case of a number higher than the highest in the disk can be

placed in the clip *I*, Fig. 2, which can be turned on the rod *B* to either side as desired, and the disk rotated as before, beginning at 0.25. The lens in the disk thus found is, of course, to be added to that in the clip, in order to have the full strength of the lens demanded. Not the least important use of the clip, however, is for holding the cylinder which has been selected for the correction of any existing astigmatism. This is very important, in many instances, for verifying the findings by other methods.

The graduated tape-measure *F* attached to the disk enables the observer to measure his exact distance from the eye under examination, which is necessary in the method as used by Jackson and others.

This apparatus, I claim, has the advantage over a somewhat similar disk devised by Doyne of Oxford, and exhibited at the International Medical Congress in Washington in 1887, in so far as it is less cumbersome, more easily manipulated, and is much less expensive. The disk can also be mounted on a stand, like a photographer's head-rest, which would allow of its being moved from place to place. Under certain circumstances this is the preferable form—for instance, where a special dark-room is not available. The instrument is made under both forms by Queen & Co., Philadelphia.

A NEW TREATMENT OF CHRONIC TRACHOMA.

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(*With Drawings.*)

BEFORE proceeding to describe in detail the treatment I have adopted during the last two years with success in a large number of cases of chronic and subacute trachoma, I hope it will not be considered foreign to the subject if I endeavor to place before the reader the facts upon which I base my definition of trachoma and its allied diseases.

Were the forms of the disease clearly defined and understood by every one, such a course would be superfluous, but, unfortunately, this is far from being the case. I therefore may be pardoned if I try to state clearly the exact meaning to be attached to the words chronic trachoma, and preface the description of the operation by a few remarks on the nature of the disease, otherwise my method of treatment would be open to the objection of being credited with the cure of a disease which would have got well equally rapidly under any kind of treatment. Besides, I wish to be able to point out more clearly the class of cases in which modifications of the treatment may be desirable.

Trachoma naturally resolves itself into the acute and chronic forms, but as the former embraces or enters into a variety of closely allied diseases, such as oph. contagiosa, blennorrhœa acuta, and gonorrhœal ophthalmia; and as, moreover, the relationship between the trachomatous and the gonorrhœal poison would involve a discussion out of place in

this paper, I shall omit all further reference to the acute form, especially as the treatment must be conducted on totally different principles.

Following the classification adopted by the German school, which is by far the simplest and most intelligible, I shall consider trachoma under the following heads:

First. A papillary or epithelial form corresponding to the chronic trachoma of Saemisch, a form in which an hypertrophy of the conjunctival papillæ is the prominent sign, but in which the follicles are hidden from view.

Secondly. A follicular or improperly termed "granular" form, in which the follicle forms the chief characteristic, corresponding to the conjunctivitis follicularis acuta of Saemisch, the blennorrhœa granulosa of v. Arlt, the trachoma folliculare of Horner, and the trachoma verum of others (Mandelstamm). Unfortunately, some authors call this latter the "papillary" form, which leads to great confusion and should only be applied to the first form, while others misname the follicles "granules," or "granulations," thereby confusing the discrete lymphoid follicles with the surface granulations. The first and second forms very often occur together and form the mixed form, "tr. mixtum" of Stellwag, in which the follicles lie in and beneath the hypertrophied or injected papillæ, though partly visible to the naked eye. For exaggerated and advanced conditions of this latter form, Stellwag has given the names trachoma diffusum and tr. sulzicum.

Lastly, we have to notice the disease known as follicular conjunctivitis—which many authors recognize as a variety of the second form above mentioned, but clinically it is to be distinguished as it is readily curable and never leads to those disastrous changes in the lids and corneæ so common in trachoma proper. In this follicular catarrh, the follicles are for the most part confined to the retrotarsal fold of the lower lid, although they undoubtedly occur in both lids. They are oval in shape rather than round, being smaller, more prominent, and more transparent than in trachoma proper, resembling vescicles rather than tubercles, and never found hidden in the deeper structures of the lid.

It has been repeatedly demonstrated that the characteristic feature of both these forms of trachoma is the follicle [1]; although in many cases of papillary trachoma the follicles are completely hidden to view by the swollen, gelatinous, or hypertrophied conjunctiva of the lids and retrotarsal folds, nevertheless they are always present, and may be readily found, if desired, by snipping a minute piece of the conjunctiva and subjacent tissue out of the lid, as I have proved for myself on several occasions. It is a simple and harmless test, and, if properly done, leaves no scar behind.[2]

Many different kinds of irritants will produce simple hypertrophy of the papillæ, and therefore one must never fall into the error of diagnosing trachoma by the mere presence of an inflamed lid covered with papillæ or "granulations," for every one must be familiar with cases where an atropine solution, or even ectropion of the lid exposed to the air, has produced a chronic catarrh with more or less velvety "granulations." In these cases it is only by observing the course of the disease and the actual demonstration of the follicle, that we can arrive at a true diagnosis. But although many mechanical irritants will produce these papillary hypertrophies, I am not aware that in the absence of micro-organisms they are sufficient to produce true trachoma. The few microscropic sections and cultivations that I have been able to make are in entire accordance with the now well-known observations of Rhein, that not merely several forms of micrococci, but several species of bacteria, are capable of inducing trachoma. I am inclined to the view that these pathological products, *the follicles*, are of the nature of a proliferating lymphoma, due to the irritation of the natural lymphoid tissue, probably by a microbe, and certainly by some prolonged source of irritation.

Whether the trachoma takes the form of a papillary hypertrophy, or a true follicular formation, depends largely

[1] Ohne Follikel kein Trachom! Aber auch kein Follikular-Catarrh! Mandelstamm. *A. f. O.*, 1883, i., p. 76.

[2] I have never been able to satisfy myself that follicles ever occur as a natural product in healthy eyes which have not been subjected to prolonged irritation, although Dr. Rhein has demonstrated that in at least one other disease, viz., tubercle of the conjunctiva, follicles, identical in all respects with trachoma follicles, may be met with. *A. f. O.*, xxxiv., 3, p. 65.

on the resistance offered by the surrounding tissues, by the vitality of the lymphoid cells, and, lastly, by the nature and duration of the irritating cause.

We may, with Raehlmann,[1] conveniently divide the disease into three well-marked stages for the better explanation of the treatment.

The first stage is that of the formation and proliferation of the follicles, accompanied by more or less pannus.

The second stage is that of the fatty degeneration and secondary metamorphosis of the follicles, followed by ulcers and the formation of granulation tissue.

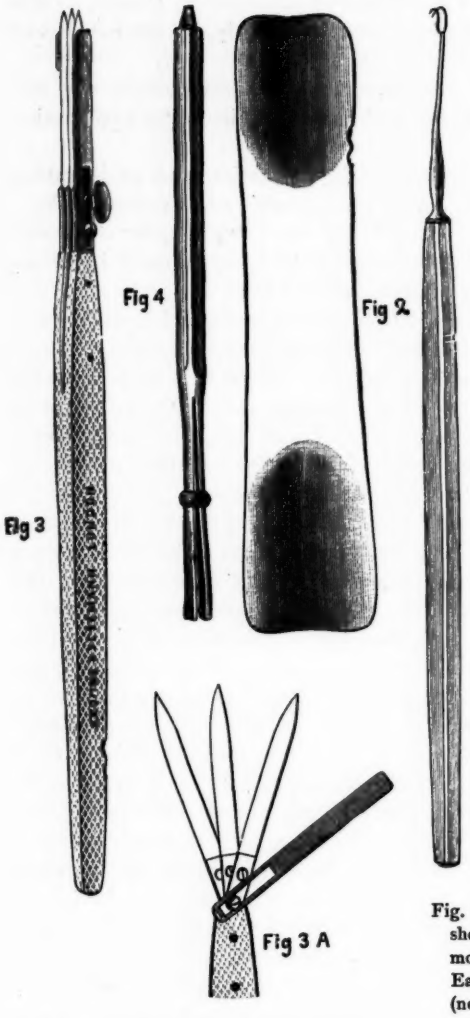
The final stage, that of scar formation, which is the natural termination of the disease, often leading to xerosis.

From a therapeutic point of view the first stage is by far the most important of the three, for it is the only one in which an absolute cure can be effected. It is a stage which may last for many years, varied by alternating periods of improvement and relapses.

Although the trachoma follicles are probably products of the irritation set up, still we have reason to believe they are at first rather a consequence or product than a cause of the disease, and it is only when they undergo degenerative processes, and so act as foreign bodies, that they set up an irritation and tend to slough out. As this will always occur sooner or later, our object in treating the disease must be to procure a speedy outlet for the follicles, and to effect such changes as will destroy the vitality of the organisms, or at any rate decompose or render harmless the poison present.

Now it struck me that the reason why the method of treatment hitherto adopted did so little towards relieving the patients was because the remedy applied was mainly a surface treatment, and whilst the astringent used, be it copper, zinc, silver, tannin, naphthol, or carbolic acid, benefited the surface and contracted the vessels, yet it failed to penetrate to the deeper structures of the lid, and especially beneath the fornix conjunctivæ, where the follicles abound. On the other hand, the heroic treatment with the galvano-cautery

[1] See Volkmann's Sam. kl. Vorträge (1885). Ueber Trachom (No. 263), a most comprehensive article.



EXPLANATION OF FIGURES.

Fig. 1. Double bent hook, used for stretching the conjunctiva over the spatula.

Fig. 2. Spatula, curved so as to rest against the upper surface of the lid.

Fig. 3. A three-bladed sillonneur, with movable guard.

Fig. 3A. Showing the sillonneur open to enable the blades to be cleaned.

Fig. 4. Handle to hold the blades when required to be sharpened.

Fig. 5. The platinum electrolyser.

Fig. 5A. The platinum ends, showing how they may be moved aside for cleaning. Each blade works on a hinge (not seen in the wood-cut).

Fig. 6. Blunt button-shaped electrolyser.

The instruments have all been made to my design by Messrs. Krohne & Lesemann, Duke Street, Manchester Square, London.

led to such scarrings and contractions as to make the remedy as bad as the disease, and thus to entirely defeat the end in view.

In the course of practice it occurred to me that, by electrolysis, I could eliminate the follicles and reach their cause, and by employing needles as the terminals, I could penetrate the deeper layers. Experience taught me that more complete and radical methods would have to be adopted, and accordingly I had an instrument prepared wherewith to open up the deeper structures of the lid more thoroughly. From time to time I made various modifications both in the instruments themselves and in the method of using them, which it will be unnecessary to mention now. I will therefore proceed to explain the operation as I now practise it.

The Operation.

If the case be one of chronic trachoma of either the papillary or follicular variety, in the less advanced stages, before cicatricial changes have set in, I proceed as follows. The patient being placed under an anæsthetic—and he must be very completely narcotized, owing to the sensibility of the parts,—the upper lid is everted over the end of the vulcanite spatula (Fig. 2), and the conjunctiva kept tightly stretched over it by means of the double hook (Fig. 1).

This should be inserted close to the free edge of the mucous membrane of the eyelid. I have had the spatula made of vulcanite, it being essential that the same should be a non-conductor in order to protect the subjacent structures. Moreover, the two ends of the spatula are of different sizes to fit a large or small eyelid. These two instruments should now be firmly held between the finger and thumb of the left hand, while the three-bladed scalpel, or "sillonneur" (Fig. 3), is taken in the right hand. This should be held lightly like a pen, and the movable guard adjusted to a distance of 2 *mm*, 3 *mm* or 4 *mm* from the tip, according to the looseness of the conjunctiva, the œdema of the papillæ, and the general appearance of the lid—in other words, the more succulent the mucosa or the larger and thicker the papillæ, and the more swollen and congested the parts gen-

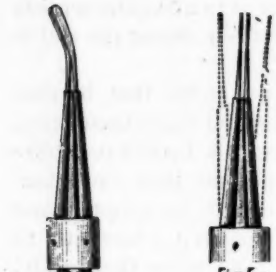


Fig 5a

Fig 5

Fig 6

erally, the deeper must be the incision. On the other hand, the more the lid approaches the follicular variety, and the more anæmic the lid, the shallower the cuts need be. The incisions are best made parallel to the edge of the lid in a gentle curve, the first incision being made close to the edge and the others following in regular succession towards the retrotarsal fold. (See Fig. 7). About fifty small tufts of absorbent cotton-wool, previously dipped in an aqueous solution of boracic acid or hydronaphthol 1:1100, and then squeezed nearly dry, to be kept in readiness by the assistant, who should rapidly mop up the blood in the track of the sillonneur (3-bladed scalpel).

Having made a complete cut from corner to corner with the sillonneur, the next incision must be made in the track of the first; *i.e.*, the first blade of the sillonneur must run in the groove made by the third blade of the previous cut. The cuts must be made by a *finger* and not by *hand* motion, otherwise the cuts will not reach the further side of the lid; in other words, the instrument should be moved so as to become vertical towards the end of the incision. After sev-

eral cuts have been made in this way, the hook must be released and reinserted farther away from the free edge, so as to put the swollen retrotarsal fold on the stretch. The cuts are to be continued several times in this manner, and the hook is to be reinserted at the posterior border of the cartilage, so as to get the whole of the retrotarsal fold over the end of the spatula; by this means the whole of the conjunctiva nearly up to the bulb can be incised. The bleeding is sometimes excessive, but can always be controlled by firm pressure with the cotton pads on the conjunctiva.

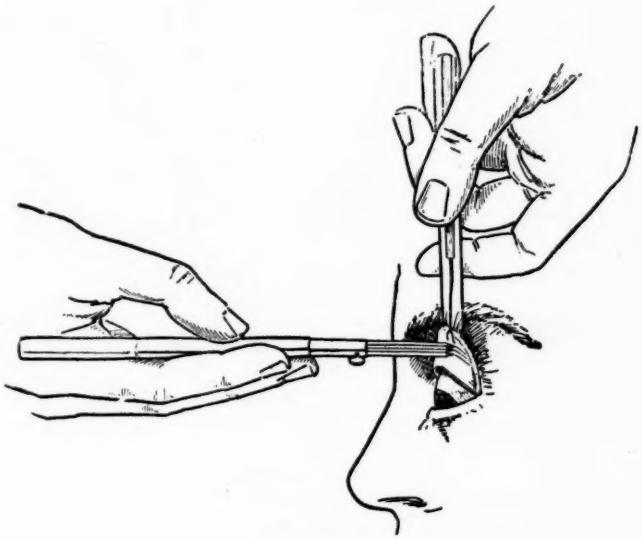


FIG. 7.

It is generally advisable to operate on both upper lids one day and both lower lids a few days later, as it is rare to find only one eye affected, and were both lids of one eye operated on the same day the inflammation set up might be excessive.

This part of the operation ought not to take more than three minutes for each lid.

We now come to the *second stage*, see Fig. 8.

The spatula being held under the everted lid as before, and the hook reinserted in its first position near the free margin, the electrolyser (Fig. 5 and 5 A) is now connected by wires with a battery. I have always used a Stöhrer's carbon and zinc battery of twenty cells. The instrument being held in the right hand, the lower edges of the two platinum blades are pressed firmly in the first two grooves made by the sillonneur and very slowly drawn along the furrows

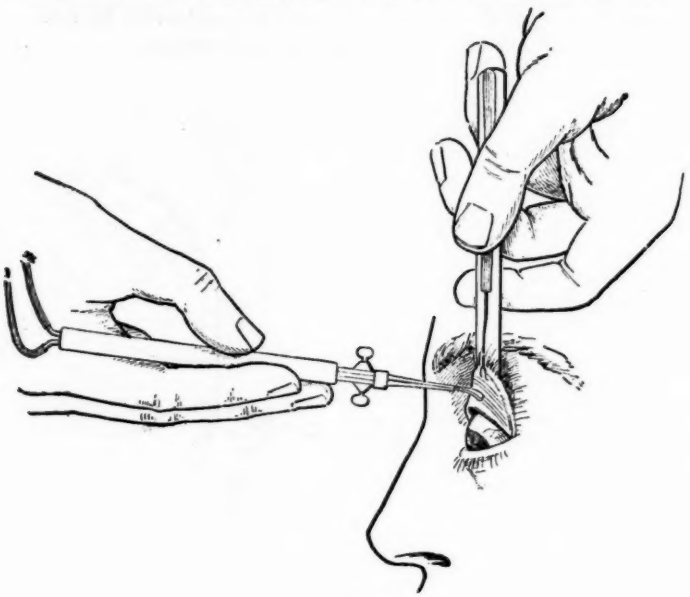


FIG. 8.

from end to end. About four or six cells (= about thirty milliampères) are used, and if in good working order the result will be at once seen by the thick foamy cream which arises round the blades. This is due to bubbles of hydrogen which are given off at the terminals (the platinum blades), and which, mixing with the blood and exudation, form the yellowish-looking froth. All the grooves are taken in turn, being slowly opened up along the lid from end to end.

Frequently the spatula will have to be shifted to enable the lid to be put well on the stretch and to allow of the platinum blades reaching well into the corners. The foam all the time must be rapidly and repeatedly sponged away, and especially from around and between the blades. This stage of the operation takes about eight or nine minutes for each lid, as the blades have to be drawn through all the furrows very slowly from the free edge of the lid to the last incision made with the knife. It will be found that the electrolytic action tends to stop the bleeding rapidly, so no fear of after hemorrhage need be entertained.

I would remark here that I have used currents of very varying strengths, and find that strong currents should be avoided. If many cells are used, *i.e.*, more than six or eight of the Stöhrer battery, the conjunctiva becomes slightly carbonized, giving to the lid an ashy-brown appearance. This not only sets up an unnecessary amount of inflammation, but, acting more like a cautery, greatly retards healing, causing slight sloughs, and often leads to small ulcers of the cornea as well. I have found as the result of innumerable trials that from four to six cells give the most satisfactory results.

Should the retrotarsal fold be very loose and much thickened, it may at this juncture be found advisable to dissect out a narrow strip of conjunctiva along the whole length of the fold. This may be hooked up by means of Galezowski's double forceps, or more simply, and I think quite as well, by the ordinary fixation forceps. I found that the conjunctiva was apt to drop between the two sets of jaws in Galezowski's pincers, and to avoid this I had a pair made with an intermediate set of jaws one millimetre shorter, *i.e.*, nearer the shank than the side jaws, but I ultimately relinquished them for the simpler process of pinching up the fold with a pair of ordinary fixation forceps and cutting away the conjunctiva beneath the jaws with a small pair of scissors narrow and curved on the flat. Unless the conjunctiva be very loose, it is best not to remove the strip of conjunctiva, or at best only to remove a very narrow one—1 *mm* or 1½ *mm*,—else too much of the fold may be picked up, and the movements of

the eyeball, if not limited, at any rate slightly disfigured by an ugly fold when the eyes are rolled upwards. This of course can only happen in the case of the lower lid, as the upper one overlaps too much to render any fold visible without everting the lid. But in the majority of cases the incisions made with the sillonneur will be found to do all that is necessary both for opening up the hiding-places of the follicles which crowd the recesses of the fold, and for cutting off the supply of blood from the vessels which help to produce the pannus. I have rarely found it necessary to cut this strip away from the lower fold, and I now only use it exceptionally in the case of the upper one.

Last Stage of the Operation.

Both lids are now washed free from blood, sprinkled with a five-per-cent. cocaine solution and dusted with calomel. Finally they are smeared over with an ointment made of vaseline and hydronaphthol, 1 to 800, and the eyes bandaged up with thick, moistened compresses. Should the inflammation during the next twenty-four hours be at all severe, which may be judged by the swelling of the eyelids, I order iced compresses to be applied and frequently changed.

I have during the last few months been using an ointment containing one part of hydronaphthol (β naphthol to 800 of vaseline, a treatment which I find is much recommended by Professor Panas in cases of chronic trachoma. I only use the proportions 1:400 to 1:800 deeming them sufficient for all purposes, but Professor Panas uses it up to one per cent., but then he uses it on the lids without previous operative treatment.[1]

For forty-eight hours the discharge from the lids is often considerable and many of the follicles slough out, but between the second and third day a decided change for the better sets in and the wounds rapidly heal. Usually at the end of a week the lids have so far healed that nothing remains to be seen except the nearly healed wounds mostly hidden by a slight velvety injected surface. If the current has been too strong or too long applied, the sloughing may

[1] *Archives d'Oph.*, January–February, 1889.

continue for at least a week, and thick cicatricial bands will be ultimately found, irregular in direction, and rarely following the course of the incisions. Although as yet I have never had a case in which these artificially made scars produced any entropium, yet they always cause a slight unevenness on the lid; it is prejudicial to the rapid clearing up of the pannus. But if the strength of the current be attended to, and a very good idea can be formed by the amount of foam and the change of color in the conjunctiva, these scars will never happen. Formerly I was accustomed to prolong the action of the current until the lid gradually changed to a brownish color, but subsequent cases have taught me the bad effect of allowing the current to play over any part too long. It is a good plan to insert a galvanometer in the track of the wires, if there is any doubt about the strength of the current, and Stöhrer provides an excellent and very portable one for this purpose, but a little experience will enable the operator to dispense with it, as it is rather in the way, and one has not much time to look at it. The current should not exceed fifty milliampères.

Formerly I found it necessary to repeat the operation on both upper and lower lids but by using a weaker current, and at the same time using the platinum blades more thoroughly and systematically, I have found one operation quite sufficient.

As soon as the wounds have healed up I wash the lids with a hot boracic lotion each day, afterwards smearing them over with vaseline or hydronaphthol ointment, 1:800. This should be continued for at least three weeks. It is not necessary to keep the patient in bed during the treatment, as I have operated on a large number of out-patients and they have apparently done quite as well as those whom I have taken into the wards, provided they had good diet and well ventilated rooms. Great care should be taken not to touch the cornea during the operation, as rather severe ulcers and abscesses may ensue by neglecting this. But with ordinary care there is no danger whatever. At the same time, should any sign of corneal ulceration be seen, the operation must be postponed, for, as every one knows, corneal

ulceration and abscess are among the frequent complications of trachoma.

An important adjunct to the treatment is attention to the bodily health of the patient. Trachoma in this country at least seems to flourish chiefly among ill-nourished and strumous subjects. As regards internal medicines, those which may be looked upon as supplementary to foodstuffs, like cod-liver oil and the phosphates and hypophosphite syrups of Parrish and Fellowes, are the most satisfactory. Children rarely refuse the oil when administered with equal quantities of the above syrups after meals. About a fortnight or three weeks after the operation it is advisable to send the patient to the seaside or the hills, to prevent the possibility of re-infection (unfortunately a common occurrence). The highest spot above the sea level is the best. Chibret says that at an altitude of 200 metres trachoma loses its contagiousness, and the follicles do not increase. How far this is true I do not know, but the testimony appears unanimous as to the close inverse relationship between altitude and the frequency of trachoma. It is a well-known fact that as we follow the rivers from their mouths to their sources trachoma diminishes, in proof of which we need only mention the familiar examples of the Rhine, the Loire, and the Nile, and (as I have been personally informed), in a still more pronounced degree, among the natives of the Congo and the Niger.

Cases of trachoma folliculare must be treated somewhat differently from the papillary variety. In the former, a very weak current of two to four cells only should be used, nor should the application be prolonged or the incisions so deep. I have in my notes records of two cases in which a great deal of inflammation followed, together with ulceration of the cornea from ignorance of this fact. In one of the cases, which, fortunately, is the only case of the kind I have met with, the patient had an ulcer of the cornea at the time of the operation, which spread so rapidly afterwards as to become uncontrollable, and in spite of every care ended in total leucoma. The other eye, which was operated on at the same time and in the same manner, recovered perfectly, all trachoma disappearing and the pannus

cleared up sufficiently to enable the patient, from counting fingers, to read J 4 and $\frac{20}{60}$ Sn a month afterwards. In the other case—a private one—an ulcer of the cornea followed, which caused a great deal of trouble for some time afterwards.

The first of these two cases was among my earliest, and greatly discouraged me at the time. I have performed the operation ninety-six times since, and omitting the two cases previously mentioned, have never known any evil consequences follow.

I have never yet had a case of trachoma, mixtum or papillare, of which this treatment has failed to answer my best expectations. I suppose the reason why the uncomplicated follicular type does so badly under severe treatment is owing to the absence of the pronounced vascularity which is so characteristic of the other forms. It might be thought that partial gangrene or at least extensive ulceration might follow such repeated incisions, but this practically never occurs, and it can only be accounted for by the very abundant vascular supply and extensive network of anastomoses with which the lids are furnished.

I have been repeatedly asked whether entropion or ectropion does not ultimately follow the operation. I can answer positively that I have never yet seen a case in which the slightest abnormal curvature has followed in consequence of the operation.

The second stage (ulceration of the follicles) is best met by frequently dusting the lids with calomel powder and anointing with vaseline and hydronaphthol, after previous irrigation with hot (100° F.) two-per-cent. boric-acid solution. This should be done every day.

In cases where the palpebral fissure has been much reduced, by the adhesion of the lids at the outer canthus, after repeated attempts to maintain the fissure permanently open to its natural width by various plastic operations, I have at length succeeded in obtaining a partial but permanent separation of the united parts of the lid by the following operation, which is merely an adaptation of Baker's operation for separating webbed fingers. I procure a piece of silver wire, the size of a No. 2 nasal probe, and file one

end until it is double-edged like a suture-needle. I then pass the pointed end of the wire between the united lids and the globe, and with the finger of the other hand overlapping the outer rim of the orbit as a guide, push the wire through the seam of the lids and skin. I then pull half the wire through, cut off as much as necessary with cutting-pliers, and with two blunt wire pliers, attached to each end, bend the wire so as to form a ring the size of a sixpence. I then pass a narrow piece of strapping, two and a half inches long, through the ring, with the adhesive sides facing each other. These being pressed together over the join of the ring, and the free end being placed on the cheek, the strapping is kept in its place by extra strapping laid over it. By this means movement of the ring is possible without the cut ends being able to slip round and fret the conjunctiva. After being worn for a month, so as to form a permanent cicatrix round the wire, I divide the tissues with a sharp knife up to the ring, which now drops out, and with some fine silk sutures draw the conjunctiva over the wound of each lid, to prevent reunion. I always make the fissure longer than normal, as at least half is sure to become obliterated in course of time. The lids should be pulled away as far apart as possible every day for weeks.

In the stage of xerosis I have obtained considerable benefit by washing out the conjunctival sac and lids daily with a hot two-per-cent solution of boracic acid, and scraping away with a knife all the white froth from the globe. This froth I have repeatedly submitted to the microscope, and it appears to consist almost entirely of epithelial cells, cocci, and short rods, as figured and described by Leber (*A. f. O.*, 1883, iii., p. 225, and Tab. 8). This removed, I drop on to the eye a solution of boracic acid in glycerine to keep it moist. Sometimes the patients prefer to have the eye frequently powdered with calomel.[1]

[1] The calomel powder which is blown in (preferably by a ball atomizer) should be very pure. I always have mine prepared by stirring it in a large volume of distilled water for some time, leaving it to settle—decanting and drying gently over a water-bath. The calomel when quite dry is finally triturated in a mortar. This treatment eliminates all the perchloride which may be present. As Dr. Weeks has shown (KNAPP'S ARCHIVES, vol. xvi., p. 377), calomel is a powerful antiseptic, although this property is not due to its partial conversion into $HgCl_2$ by the action of the salts in the tears, as I have shaken up calomel with the lachrymal secretion for hours without finding a trace of perchloride afterwards.

The superficial and interstitial opacity which exists is best treated by the direct application of a platinum button (Fig. 6) to the cornea, the instrument being connected to the negative pole of the Stöhrer's battery opened to about four cells, the positive pole at the same time placed anywhere on the forehead. Each application should last about four minutes, and is generally quite painless if cocaine be used first, as the nebulous cornea is comparatively insensible.

I think it is unnecessary to burden this paper with an account of the numerous cases which I have treated. Suffice it to say they embrace every stage of trachoma, while a considerable number have previously been the round of the hospitals and dispensaries, many having been under treatment for four, five, or even ten years previously without receiving permanent benefit. I am greatly indebted to the medical superintendents of several of our London workhouses and infirmaries for keeping me supplied with cases, and especially to Dr. Milne, who placed all his trachoma patients in Her Majesty's Hospital, Stepney, under my care.

It would be ungrateful of me to conclude this paper without expressing my warmest thanks to Mr. Lawson, who first permitted me to demonstrate the operation at Moorfields, and to Professor Tweedy for his valuable aid and advice. I should also like to thank Dr. Sartain, of Philadelphia, who, during his stay in England, kindly assisted me in many of the operations.

REPORT ON A THIRD SERIES OF ONE HUNDRED SUCCESSIVE CATARACT EXTRACTIONS WITHOUT IRIDECTOMY.[1]

By H. KNAPP.

THE series of cataract extraction to be reported in the following pages, were all performed by myself in the N. Y. Ophthalmic and Aural Institute, between Jan. 5, '89, and Jan. 24, '90. During my absence in March and August, a number of extractions were made at the "Institute" by Dr. R. O. Born. They are not included in the following report; nor are there included eleven operations of my own which do not fall within the limits of our subject. I shall speak of these eleven operations separately, so that no case that has been operated on by me within this period, shall be passed over in silence. The eleven cases set apart were as follows:

TWO CASES in which the functional examination revealed intraocular lesions, probably detachment of the retina, were admitted to operation with a doubtful prognosis. Their recovery was without essential disturbance; in the one a small prolapse of the iris occurred, but did not prevent a smooth healing process. The patients, though preserving the normal shape of their eyes, did not recover sight. I have often operated under similar circumstances, and have had the pleasure of obtaining useful sight in a certain number of patients. In some cases, I think, it is not possible to diagnosticate detachment of the retina before the

[1] The First Series was published in vol. xvii. (1888), p. 51, etc., the Second Series in vol. xviii. (1889), p. 1, of these ARCHIVES. The different series are the immediate continuation of one another, so that no case operated on is omitted.

operation. Perception of light may be preserved in the whole field of vision if the retina is raised only in small folds. When there is no cataract we make the diagnosis in such cases not so much from the examination of the visual field as with the ophthalmoscope.

A THIRD case was the extraction of a chalky lens dislocated into the vitreous and complicated with total detachment of the retina. The eye was blind. The operation was undertaken only for cosmetic reasons and to remove the irritation of the whole eye produced by the movable lens. The operation, which completely answered our expectations, is described in the previous number of this volume, p. 53.[1] I should not omit to mention a case of extraction of a secondary cataract in which the lens had shrunk after two needlings, years ago. The patient, Mr. Wright, thirty-one years old, addicted to drink, having his face full of acne pustules, was unruly during the operation, and made a sudden movement with his head while I was drawing the lens out with a Mathieu forceps. The cataract came out clean, but with escape of vitreous. The pupil was clear and central, but the eye was lost by suppuration of the vitreous, evidently through infection from his diseased skin and conjunctiva, in spite of careful sterilization of both with soap and bichloride of mercury. Dense secondary cataracts are, perhaps, the most dangerous objects to deal with, division and incisions being mostly impracticable, always dangerous. Extraction seems to be relatively the safest procedure. It may be total, if the resistances are not great, or partial, *i.e.*, a portion is drawn out of the wound and cut off.

There were seven cases in which I made iridectomy during the operation. Briefly detailed they are as follows:

CASE 1.—Pat. Dunn, æt. 67, operated in his bed, regular section. Large lens expelled without difficulty. Several attempts to obtain a round pupil were unsuccessful. Tendency to prolapse. Iridectomy made. Recovery undisturbed. S $\frac{20}{100}$. Discission. S $\frac{80}{70}$.

CASE 2.—A. M. Stähle, æt. 68. Conditions as in previous case. Recovery. S $\frac{80}{70}$.

[1] On the Extraction of Lenses Dislocated into the Vitreous.

Case 3.—Mrs. Rath, æt. 63. Splitting of capsule with knife during the section; a *peripheric part of iris cut off*, the central part drawn out with forceps and cut; during the cleansing of the eye, which was made very difficult by nervousness of patient and forcible closure of the lids, some *vitreous escaped.* Recovery smooth. S $\frac{20}{100}$. Disc. S $\frac{20}{40}$.

Case 4.—Mrs. Long, æt. 62. A peripheric portion of iris fell before the knife during a sudden pressure of the patient and was exsected. The central portion was then likewise removed. Extraction of lens as usual. *Purulent kerato-iritis.* Eye lost. As a possible cause of the infection it may be mentioned that, in order to disinfect a somewhat congested conjunctiva, a strong solution of nitrate of silver had been brushed in without my knowledge.

Case 5.—Noah Selbig, æt. 91. Cataract complicated. On account of great narrowness of pupil, an iridectomy was made. Expulsion regular, followed by unusual collapse of the cornea. *Purulent kerato-iritis* without any assignable cause. Loss of eye.

Case 6.—Mrs. Roberts, æt. 56. Patient utterly unruly, screaming like a child, and pressing lids together; therefore iridectomy. Expulsion of lens without accident. Recovery with good sight.

Case 7.—Mrs. E. Rhoden, æt. 57. Cataract swollen by imbibition, removed without accident, but the iris lay in the wound and, the patient being uncontrollable, was abscissed. Cleansing of pupil. No reaction. S $\frac{20}{100}$. Disc. S $\frac{20}{40}$.

Intercurrent with the first 100 cases of simple extraction there were 17 in which I made iridectomy; in the second 100 cases there were 13; in the third series only 7. Instead of finding an iridectomy desirable in a greater number of cases, as some operators have done during the last years,[1] I have constantly reduced the number. There will always be special indications for iridectomy, but I do not think that I shall ever cease to practise simple extraction as a rule.

With regard to the

Mode of Operating,

the experience of the last year has not been without influence on certain points in the technique.

[1] In the Report of the Eye Clinic of Prof. H. Sattler, of Prague, for the year 1889, I read, p. 4: "Extractions according to von Graefe, 213; extractions with a small flap without iridectomy, 4."

1. **Copious injections into the anterior chamber, with any liquid whatever, seemed to irritate.** I have therefore limited the injection to letting a small quantity of a very mild antiseptic—a solution of one half per cent. of chloride of sodium in boiled water would probably be the best—flow through the whole extent of the section. I introduce the point of a fine syringe into the anterior chamber, and, pressing gently on the piston, let the water flow over the wound from within outward. When the liquid is forced through the wound by directing the stream from outside in, particles that may be in the conjunctival sac or in the wound will be driven into the anterior chamber, as the entrance of bubbles and particles of blood-clots frequently demonstrate. I have spoken of this before, but like to repeat it, as the reverse method is followed by men whose opinions I consider very valuable.

2. **Liberal irrigations with corrosive sublimate,** $\frac{1}{5.000}$, produced indelible staining of the cornea in two cases, making the operation in one case (No. 33) result in failure, in the other (No. 37) in the recovery of moderate vision only. I do not think that we should condemn these irrigations altogether, but I should make them rigorously only where a septic condition of the conjunctiva—as in the unconquerable chronic dacryocystitis—seems to be present; whereas, under aseptic conditions, they may be employed mildly, and the intraocular injections totally omitted. Sure it is that the most painless and smoothest recoveries are obtained when neither irrigation nor injections are made. But then we must be sure that the region of the operation, in and outside the lids, and every thing that comes in contact with the wound, is perfectly aseptic. The cleansing of the lids, especially the ciliary margins, with soap and bichloride seems to me very essential. In regular operations this may not matter much, but if there be escape of vitreous there is a good nutrient fluid spread from the lids uninterruptedly into the eye. I have never seen this better illustrated than in the case of Mr. Wright, the extraction of the shrunken lens, mentioned above (p. 281).

Any thing that produces a congestion, be it exposure to dust, lack of sleep, irritants such as corrosive sublimate or

nitrate of silver in a strength to cause hyperemia, lymphatic exudation, and exfoliation of epithelium, *i.e.*, food for bacteria, should be strictly kept off the eye for days previous to the operation. I like to have my patients one or several days in the hospital, in good air, perfectly resting their eyes and bodies, doing nothing except washing their faces and eyes with soap two or three times daily. If, by this treatment, a congested conjunctiva has become pale and shining, I consider the patient in a fit condition for the operation.

3. **I do not adhere exclusively to one particular kind of dressing.** Nobody will contest the truth of the old dogma that one of the chief requisites for securing primary union in any wound is rest of the part, as absolute as we can have it without interference with the patient's general health. If I were to be operated on for cataract, I would sacrifice a great deal of my comfort for the smallest gain in security. In winter, and with quiet patients, the binoculus, as far as I can judge, fulfils the conditions of rest better than any other dressing. With nervous patients, and in summer with almost all, I place a patch of corrosive-sublimate gauze on the eye, a small pad of absorbent cotton on it, and hold them in position by strips of plaster. Strips of isinglass plaster immediately on the lids are, to some patients, on account of their stiffness, more unpleasant than either of the two modes of dressing mentioned above. Apart from this, the removal of the plaster by tearing it off requires somewhat forcible pulling of the lids, which, in a recently operated eye, may disturb the wound, and if we soak the plaster first it consumes an inordinate time. Should secretion occur, the plaster is incontestably inferior to the gauze. During the hot weather of this summer, I have closed a greater number of eyes with isinglass plaster, simply, as recommended by C. E. MICHEL of St. Louis,[1] J. J. CHISOLM of Baltimore, and others. The results, thus far, have been favorable.

I think also that it is safer to let the patient lie in bed the first days after the operation than to give him the freedom of

[1] See his paper: "Dark Rooms and Bandages discarded in the after-treatment of Cataract Operations, Iridectomies, etc.," in these ARCHIVES, Vol. XV., p. 318, etc., 1886.

the house. When one eye is not bandaged, the patient will look about, and the closed eye will accompany the movements of the other.

4. As is well known, **hypostatic pneumonia** will occasionally develop in decrepit people after extraction of cataract. Until lately I have had no such case in my whole practice—I have made over two thousand cataract operations—and last year two cases, fatal, as almost all are, occurred within a short period. The one was a man of forty-three years of age, the other a woman of seventy-four. In neither were there any promonitory symptoms. The disease declared itself over night, as the usual pneumonia does, from which, however, it is distinguished by the purely bloody character of the sputum and the absence of bacteria. In neither of our cases were bacteria found in the sputum. In both the pneumonia set in when the eyes were cured and the patients out of bed—in the man, on the tenth day after the operation on the second eye; in the woman, on the twelfth day. Both had made excellent and undisturbed recoveries from the operations. What rules can be deduced from these cases? Certainly to let old people not lie too long in the same position, and to sustain their forces. In neither of our cases had these rules been disregarded, for both were well, had no reaction from the eye operation, enjoyed good appetite, and no food was forbidden to them. Besides, they both were up when the pneumonia set in. I think that Snellen goes too far in recommending old people—as I am informed he does—to get up one or two days after the operation and sit in the yard. When a patient complains of the bed, let him sit up in his room, which can always be ventilated sufficiently to let him breathe fresh air. In institutions where many patients are crowded in the same room, as is the case in most hospitals, this, of course, is different.

5. With regard to the **technique of the operation, I shall change the section in so far as to make it less peripheric.** I do not hesitate to place myself on record in asserting that **one of the greatest errors** *ever committed in the history of cataract extraction was the introduction of the peri-*

pheric section by J. Jacobson, late professor of ophthalmology in the University of Königsberg. I had enough of the peripheric section with all its irido-cyclitic consequences when I practised extraction with iridectomy. Since 1886 I have followed De Wecker and Panas in making the section exactly in the transparent margin of the cornea, rather with a leaning toward a conjunctival flap. My experience leads me to infer that the old dogma, enunciated by Mackenzie and others, is true, *i.e.*, the farther away from the centre you make an opening into the cornea, the more you will have incarceration and prolapse of the iris. There are two oculists who claim scarcely ever to see hernia of the iris after cataract extraction. I mean Galezowski of Paris and C. S. Bull of New York. Galezowski says that he does not open the eye before a week elapses; Dr. Bull lays stress on operating on his patients in their beds. I have done the one and the other, and have had hernias; but another feature which Galezowski and Bull have in common, is that both place the apex of the section within the cornea, Galezowski *2mm*, as he stated five years ago, and Dr. Bull, when I questioned him recently, said that the apex of his section lay always in the clear cornea. I have shifted occasionally toward the old peripheric section with a conjunctival flap, and whenever I did so prolapses were more frequent. A conjunctival flap has its advantages. The wound closes more quickly, and is much better protected from secondary infection. Sections lying wholly in the cornea frequently show a "riding flap"; that is, the distal flap projects over the proximal. This produces a groove. Slow union of the wound and tardy restoration of the anterior chamber are the consequence. The latter is unimportant, but the former, creating a nidus for bacteria, is dangerous. My sections of late have been less peripheric than before, and I intend giving this, the Galezowski section, a fair trial. The liability of prolapse of iris is the weak point in simple extraction. Dr. Bull says he has never had real prolapse, *i.e.*, hernia, but he confesses a considerable number of incarcerations. Besides, in thirteen of the one hundred cases which he has reported there was escape of vitreous, a number which is far

greater than the average. These points can be settled only by extensive observation, and as no man can do every thing, we should all work in concert and learn from one another.

6. Regarding the **management of the capsule** my experience may be of value. In 64 successive cases I have opened the capsule with the knife in its passage through the anterior chamber, the old procedure of Wenzel (1808), recently revived by Galezowski, Gayet, and Mooren. I have abandoned this procedure as a general method, and have published my results from it, its advantages and disadvantages, in the last volume of these ARCHIVES, 1889, p. 169. I shall therefore not refer to it now. Since then I have practised the **peripheric opening** of the capsule, by introducing a delicate, sharp cystitome under the upper part of the iris and splitting the capsule as I used to do in the extraction with iridectomy. When I formerly tried this procedure I thought that the exit of the lens was less easy, but now, on extensive trial, I find that the lens escapes quite readily, and that I have no longer adhesions in different parts of the pupil, but either a single adhesion in the upper part or none at all. Thus I gain a clean area in which to practise the final clearing of the pupil, the secondary discission of the capsule. The cystitome needles which Tiemann and Meyrowitz made for me are delicate and sharp, so as to cut and not tear, similar to the cystitomes I used for the peripheric capsulotomy in Graefe's extraction, with the only difference that the stem of the new cystitome is not straight, but slightly bent, because it has to be introduced into the anterior chamber and then turned. The manœuvre is not difficult.

7. Another point to which I have given much thought is the **extraction of a piece of the anterior capsule,** a procedure which seems to be in very extensive use with the most renowned operators in Europe. In hundreds of cases I removed a central piece of the anterior capsule when I practised Graefe's method. The results were not favorable; shreds of capsule were but too apt to lodge in the section and be the passage-ways of infection, ushering in plastic and purulent inflammations. With the simple extraction this is not to be feared, because the iris is interposed between

capsule and corneal section. But I have found other difficulties in this procedure. I have not always succeeded in what I attempted to do, or, in case I succeeded, have torn the capsule too extensively, especially toward the corneal section, causing vitreous to follow the escape of the lens. In general I have had more satisfaction in opening the capsule peripherally, expelling the lens and then extracting the thickened portion of capsule, than in attempting to extract it before the expulsion of the lens. I know only a few of the European models of capsule forceps, among which that of Schweigger. Its teeth spread out well, but they project when the branches are closed, and the instrument is thick and clumsy. Mathieu's forceps are neat, but their teeth being parallel to the branches, they easily fail to grasp a flat and yielding membrane. I have therefore sought to modify these forceps in such a way that they can be introduced and withdrawn without showing projecting parts, but on opening in the eye the branches will revolve on their longitudinal axes making the teeth project downward and on gentle pressure grasp the capsule, return to a horizontal position when closed, and carry the grasped portion out without grating on the iris or the lips of the corneal wound. The principle is this: When the branches are closed, the teeth, being horizontal, do not project, as will be seen in the drawing, (Fig. 1, *a*), where the branches are parallel.

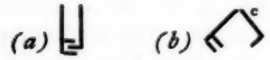


FIG. 1.

In *b*, where the branches open on the joint *c*, the teeth project downward. This does not serve our purpose, but it will do so when we attach to the end-points of the branches (*b*) prolongations at right angles, and put the teeth on the inner side of these prolongations. Then the teeth will be perfectly covered when the branches are closed, and will

project downward when opened. The instrument under consideration may not possess any new features, but I have tried it, and find that it answers the purpose. The present model which Geo. Tiemann & Co. have spared no pains in making as simple and efficient as possible, is shown in the accompanying figure (Fig. 2).

FIG. 2.

Among the **peculiarities and complications of cataract,** we may mention:

1. Two cases (27, 31) of *nuclear sclerosis*, in which the cortex was transparent. The whole lens came out without difficulty, requiring no manipulation to clear the pupil, and the visual results were good ($\frac{20}{30}$ in each).

2. Four cases (6, 29, 68, 80) had old *maculæ of the cornea* which had no influence on the operation, but decreased the vision ($\frac{20}{60}$, $\frac{20}{100}$, $\frac{20}{300}$, $\frac{20}{100}$).

3. *Atrophy of the optic disc*, two cases (2, 53), with S $\frac{20}{200}$ and $\frac{10}{200}$, the poor result greatly owing to irregular astigmatism from prolapse of iris. I may mention that slight degrees of optic-nerve atrophy, with poor sight, for instance $\frac{20}{200}$ to $\frac{20}{50}$, in good optical conditions, has not been noted, but is not at all infrequent in cases of cataract extraction. The pallor of the optic disc is the only thing to account for the amblyopia.

4. *Atrophy of choroid*, one case (5), very marked with S $\frac{15}{200}$. A number of other cases with more or less extensive crescents and opacities of the vitreous have not been specially noted.

No.	Name, Age, Health.	Cataract; Eye.	Operation, Healing Process, Duration of Treatment.	Primary S.	Secondary Operation after Extraction, Duration of Treatment.	Ultimate S.	Remarks.
1	Mrs. Grebe. 41. Good.	R. (right eye). Soft,	**1889.** Jan. 5th. Regular. 12 days.	20/20	Discission in 6 weeks. 5 days.	20/20	Before disc. the capsule was evenly spread through the pupil; fundus veiled; metamorphopsia.
2	Geo. Mausert. 55. Potator.	Hard, ripe, complicated.	Jan. 9th. *Severe iritis.* Traumatic *prolapse of iris* on 4th day, cut off a few hours after its occurrence. Pupillary membrane.	1/200	Disc. in 6 months. Healing smooth. Pupil clear. 4 days.	20/200	Later 5/200; white atrophy of opt. disc;
3	B. Soltau. 32. Good.	Hypermature, good.	Jan. 9th. Thickened capsule, incised and removed. Expulsion laborious. No reaction whatever. 15 days.	20/40			
4	P. H. Ward. 43. Somewhat anæmic.	Ripe.	Jan. 11th. Regular. No reaction. On 7th day had a chill, followed by pneumonia of left lung, later of right, died on 17th day of *hypostatic pneumonia*, the diagnosis, made *intra vitam* by the bloody expectoration and absence of bacteria, verified by the autopsy.	20/40			The other eye had been operated on 2 weeks previously with excellent result. Patient had lost one leg during the war.
5	Mary Sullivan. 55. Good.	L. Hard; complicated, excessive myopia with atrophic choroiditis.	Jan. 26th. Regular. No reaction. 14 days.	15/200			
6	Mary Glass. 42. Good.	Morgagnian, complicated with mac. corn.	Jan. 28th. Regular. 14 days.	20/40	Disc. 18th day. Mild iridokeratitis. 16 days.	20/20	
7	Ch. Ott. 58. Good.	Ripe, good.	Jan. 30th. Breech delivery of lens. No reaction. 13 days.	20/40	Disc. 23d day. 5 days.	20/40	
8	Mrs. Reynolds. 52. Good.	Ripe, good.	Feb. 2d. 4th day pupil round and central. No reaction. Hurt eye on 6th day. *Pupil oblong*, iris not protruding. 18 days.	20/100	Disc. 2 months. 5 days. 20/30.	20/30	
9	Chas. Renard. 72. Mentally unsteady.	Ripe, good.	Feb. 6th. Regular. 14 days.	20/200			Pupil clouded. Patient did not return for a discission.
10	Sarah Young. 73. Good.	Not quite ripe, good.	Feb. 9th. Reg. 14 days.	20/100	Disc. 21st day. 5 days.	20/50	On 6th day.
11	Mrs. E. Brown. 60. Good.	Ripe, good.	Feb. 9th. Reg. 14 days.	20/100	Disc. 9 months. 3 days.	20/30	Defective choroidal pigmentation. Optical conditions perfect.
12	E. C. Bull. 81. Feeble.	Nuclear sclerosis, good.	Feb. 13th. Reg. Pupil slightly oval. 30 days.	20/30			
13	L. Wally. 61.	Ripe, good.	Feb. 14th. Reg. 13 days.	20/	Disc. 6 weeks. 5 days.	20/	On 6th day.

11	Mrs. E. Brown. 60. Good.	Ripe, good.	Feb. 9th. Reg. 14 days.	$\frac{20}{100}$	Disc. 9 months. 3 days.	$\frac{20}{20}$ Defective choroidal pigmentation. Optical conditions perfect.
12	E. C. Bull. 81. Feeble.	Nuclear sclerosis, good.	Feb. 13th. Reg. Pupil slightly oval. 30 days.	$\frac{20}{20}$		
13	J. Wally. 61 (negro). Good.	Ripe, good.	Feb. 14th. Reg. 13 days.	$\frac{20}{100}$	Disc. 6 weeks. 5 days.	$\frac{20}{20}$ On 6th day.
14	Mrs. Stinson. 66. Good.	Ripe, good.	Feb. 15th. Reg. 13 days.	$\frac{20}{100}$	Disc. 6 weeks. 5 days.	$\frac{20}{20}$
15	Mary Sullivan. 55. Good.	R. Ripe, complicated, large crescent.	Feb. 16th. Reg. 21 days.	$\frac{20}{200}$		$\frac{20}{40}$ In 8 months.
16	Mary Oswald. 60. Heart disease.	Ripe, good.	Feb. 27th. Reg. 11 days.	$\frac{20}{50}$		
17	Sarah Sanders. 63. Good.	Ripe, good.	March 29th. Operated in her bed. Some difficulty to get the pupil round. 4th day iris under conjunctival flap; coughed much in the morning. No reaction. 11th day, sudden pains at night, for an hour; ant. chamb. empty (injury). Slow recovery, with moderate *prolapse of iris*. 6 weeks.	$\frac{18}{200}$ Eight weeks $\frac{20}{100}$	Disc. 4 months. 6 days.	$\frac{20}{70}$ Wound cystoid. No particular irritation. Seen 11 months after extr., the prolapse almost disappeared.
18	Aug. Halbrecht. 38. Good.	Ripe, good.	March 30th. Op. in bed; reg. 14 days.	$\frac{20}{70}$		$\frac{20}{30}$ Upper part of pupil clear, lower slightly veiled.
19	Mrs. E. Lowe. 63. Good (negress).	L. Ripe, good.	April 3d. Op. in bed; reg. 17 days.	$\frac{20}{70}$	Disc. 4 weeks. 4 days.	$\frac{20}{30}$
20	Therese Buschendorf. 53. Good.	R. Ripe, good.	April 4th. Op. in bed; reg. 21 days.	$\frac{20}{70}$	Disc. 5 weeks. 5 days.	$\frac{20}{40}$ In 2 weeks, some flakes in pupil.
21	C. Gallenger. 70. Good.	L. Ripe, good.	April 8th. Op. in bed; reg. 12 days.	$\frac{20}{100}$	Disc. 5 weeks. 5 days.	$\frac{20}{40}$
22	Auguste Rosa. 35. Good.	Ripe, good.	April 10th. Op. in bed; reg. 14 days.	$\frac{20}{100}$	Disc. 4 weeks. 5 days.	$\frac{20}{100}$ $\frac{20}{40}$ In 5 days later.
23	Arth. Spiegel. 21. Good.	Soft, ripe.	April 10th. Op. in bed; reg. 12 days.	$\frac{20}{80}$	Disc. 4 weeks. 5 days.	$\frac{20}{40}$ In 5 days.
24	Jas. Conkling. 59. Good.	Ripe, good.	April 12th. Op. in bed; reg. 13 days.	$\frac{20}{100}$	Disc. 4 weeks. 5 days. On 8th day an attack of *glaucoma*, cured with eserine.	$\frac{20}{40}$
25	Miss Rockwood. 80. Good.	Ripe, good.	April 20th. Op. in bed. Patient refractory. Difficulty in getting the lens out. *Mild iritis*. Pupil round and central, a few filiform adhesions. 28 days.	$\frac{20}{200}$ later $\frac{20}{70}$	Disc. 2 months. 4 days.	$\frac{20}{30}$

No.	Name, Age, Health.	Cataract; Eye.	Operation, Healing Process, Duration of Treatment.	Primary S.	Secondary Operation after Extraction, Duration of Treatment.	Ultimate S.	Remarks.
26	Thos. Trembath. 58. Good.	R. Ripe, good.	April 24th. Op. in bed; reg. 15 days.	20/20		20/20	Capsule spread evenly through pupil, a break in centre where knife had passed. Fundus clear.
27	C. McCann. 42. Good.	L. Centre opaque, cortex clear, good.	April 24th. Op. in bed; reg. Lens came out entire. 15 days.	20/20	Disc. 7 weeks. 4 days.	20/20	
28	Thos. McCarty. 62. Good.	Ripe, good.	April 26th. Reg. 14 days.	20/20	Disc. 4 weeks. 4 days.	20/20	
29	Miss Cath. Howe. 68. Good.	Ripe, complicated corneal opacities from trachoma.	May 3d. Op. difficult on account of contraction of lids from *trachoma*. Some discharge. Healing of wound undisturbed. 15 days.	10/200		20/100	Pupil clear and round.
30	Mrs. Gert. Millet. 52 (Costa Rica). Good.	R. Ripe, good.	May 6th. Op. reg. 4 weeks.	20/200	Disc. 6 weeks. No reaction. 4 days.	20/100 later 20/20	
31	Mrs. Mart. Lyons. 60. Good.	Nuclear sclerosis, good.	May 8th. Reg. 16 days.	20/200	Disc. 4 weeks. 4 days.	20/20	
32	Mrs. McNealy. 55. Good.	Ripe, good.	May 11th. Reg. 14 days.	20/20	Disc. 5 weeks.	20/20	
33	Adolf Wrede. 68. Good.	Ripe, good.	May 11th. Reg. Wound irrigated freely with corros. subl. 1:5000. 4th day, *iris in wound*, cornea diffusely milky, whitish opacity, like a cloud before pupil in ant. chamber. On 13th day protruding iris cut. No inflammation. Cornea and pupil opaque.	Fingers at 3 ft.		1/1000	Seen again a year later. Cornea whitish-opaque. Shape of globe and T good. (Corr. subl. reaction.)
34	Wm. Dunn. 57. Good.	Ripe. Good.	May 9th. Reg. Slow restoration of ant. ch. (7 days); 14 days.	20/20			
35	John Schmolch. 56. Good.	Hypermature.	May 13th. Descemetitis from free washing out. Ant. ch. Cornea and pupil cleared up. 22 days.	20/200	Disc. 4 months. 4 days.	20/20	
36	Charlotte Bick. 61. Good.	Nuclear sclerosis.	May 15th. Reg. 15 days.	20/20			
37	Mrs. P. Cohn. 70. Feeble.	Ripe. Good.	May 18th. Ether. Op. regular. *Mila iritis*. Cornea hazy and pupil dull. Patient restless and cranky. 11 days.	6/200		6/200	A month later when last seen, cornea still hazy. Too much sublimate irrigation.
38	Joseph Samech.	Ripe. Good.	May 18th. Reg. 13 days.	20/20	Disc. 24 days. 3 days.	20/20	
39	Mrs. Hager.	R.	Almost	May 18th. Op. laborious on account of	20/20	Disc. 6 weeks. 4 days.	20/20

38	Joseph Samech.	Ripe.	Good.	May 18th. Reg. 13 days.	$\frac{20}{20}$	Disc. 24 days. 3 days.	$\frac{20}{20}$	
39	Mrs. Hager. 77. Good.	R. Ripe.	Almost Good.	May 18th. Op. laborious on account of nervousness of patient. Reg. 14 days.	$\frac{20}{20}$	Disc. 6 weeks. 4 days.	$\frac{20}{20}$	
40	Mrs. Kerr. 58. Good.	Ripe.	Good.	May 20th. Reg. 15 days.	$\frac{20}{100}$	Disc. 20 days. 4 days.	$\frac{20}{20}$	In 5 days.
41	Mrs. R. Mulligan. 74. Good.	Ripe.	Good.	May 20th. Op. reg. 4th day, small *prolapse*, traumatic; blood in chamber. Prol. cut 9th day. 18 days.	$\frac{10}{100}$	Disc. 6 weeks. 3 days.	$\frac{20}{20}$	
42	Mrs. French. 74. Feeble.	Ripe.	Good.	May 22d. Healing of eye regular. On 11th day hypostatic *pneumonia*. *Diea* 14 days later. 25 days.	$\frac{20}{20}$			
43	Mrs. Hunt. 78. Feeble.	Ripe.	Good.	May 25th. Reg. 14 days.	$\frac{20}{20}$	Disc. 6 weeks. 4 days.	$\frac{20}{20}$	
44	Dan. Moylan. 43. Good.	Cat. lactea. Iris atrophic.		May 27th. Extr. *within capsule* by external manipulation. Pupil round and central. Healing regular. 14 days.	$\frac{20}{100}$		$\frac{20}{70}$	Pupil clear. Floating opacities in vitreous.
45	Mr. Mack. 68. Good.	Ripe.	Good.	May 28th. Tendency of iris to prolapse on the slightest pressure. 4th day, patient injured eye, hyphæma, pupil central. 14 days.	$\frac{15}{100}$	Disc. 6 weeks. 4 days.	$\frac{20}{40}$	Vitreous slightly hazy.
46	Mrs. Fitzgerald. 62. Good.	Ripe.	Good.	May 29th. Reg. 12 days.	$\frac{20}{20}$			Pupil central, unusually clear.
47	Jean Klumbach. 62. Good.	Not quite mature.	Good.	May 30th. Reg. 19 days.	$\frac{20}{40}$	Disc. 6 weeks. 5 days.	$\frac{20}{20}$	
48	Sam. Birnbaum. 21. Good.	Soft.	Good.	June 1st. Reg. 17 days.	$\frac{20}{20}$			
49	Mrs. Smith. 78.	Ripe.	Good.	June 5th. Reg. *Summer dressing of eyes* (a patch of sublimate gauze, covered with some absorbent cotton, held in position by 2 strips of court plaster). 14 days.	$\frac{20}{100}$	Disc. 5 weeks. 4 days. Round, regular, black pupil.	$\frac{20}{20}$	5 months later attacks of *glaucoma*, repeating as in the prodromic stage of ordinary inflammatory glaucoma, relieved by eserine, but ultimately in March, 1890, the ant. ch. being shallow and the iris convex, $+T_1$, a regular upward iridectomy was made, which resulted in permanent recovery.
50	Mr. Southwick. 69. Good.	Hypermature.	Good.	June 10th. Reg. 10 days.	$\frac{20}{70}$	Disc. 4 weeks. 5 days.	$\frac{20}{20}$	
51	Ann Carrey. 48. Good.	Ripe.	Good.	June 12th. *Peripheric piece of iris excised, lens passed* out *through this opening*. Recovery smooth. 13 days.	$\frac{20}{40}$	Disc. 6 weeks. 4 days.	$\frac{20}{20}$	

No.	Name, Age, Health.	Cataract; Eye.	Operation, Healing Process, Duration of Treatment.	Primary S.	Secondary Operation after Extraction, Duration of Treatment.	Ultimate S.	Remarks.
52	S. Austin. 66. Good.	Ripe. Good.	June 12th. Reg. 12 days.	20/20	Disc. 24 days. 5 days.	20/20	Had S 1/15 after 2d operation. Resumed work too soon and too persistently. Had irido-cyclitic irritation 4 weeks. Recovery with good sight. 20/20. June 4th, 1890.
53	F. Miller. 69. Good.	Ripe. Complicated.	June 17th. Traumatic *prolapse of iris*. 15 days.	5/200		10/200	Atrophy of od. The prolapse has remained free from irritation, but is large. The upper part of the cornea is pushed forward so that near the centre the cornea is horizontally wrinkled, resembling a saddle surface. Regular and irregular astigmatism marked.
54	Taylor, Dr. 62. Good.	Ripe. Good.	June 18th. Reg. 11 days.	20/200	Disc. 5 weeks. 4 days.	20/20	
55	Mrs. G. Kelly. 86. Good.	Ripe. Good.	July 1st. Opening of capsule with cystotome insufficient. Expulsion of lens laborious. Some *escape of vitreous*. Recovery smooth. 12 days.	20/70		20/20	
56	Mrs. G. Millett. 52. Good.	L. Ripe. Good.	July 1st. Some *iris, falling before knife*, exsected. 21 days.	20/70	Disc. 7 weeks. 3 days.	20/40	
57	Eliza Farwell. 48. Good.	Immature. Good.	July 2d. Reg. 14 days.	20/70	Disc. 3 weeks. 5 days.	20/30	
58	Mrs. Schepp. 78. Good.	Ripe Good.	July 2d. Some adhesious. 16 days.	20/70	Disc. 6 weeks. 5 days.	20/50	
59	Jos. Beermender. 46. Good.	Tremulous. Op-ac. cornea. Atrophy iris.	July 3d. Capsule drawn out with Mathieu's forceps. 3d day *small prolapse*. Healing good. 15 days.	15/200		20/50	Prolapse cut in 6 weeks.
60	Mrs. Dubréus (Haiti). 45. Good.	Ripe. Good.	July 3d. Peripheric section. Small piece of iris cut. *Glaucoma* developed on 6th day; shallowness of ant. chamb. Eserine and pilocarpine reduced tension, but wound gradually bulging.	5/200		20/200	Seven weeks after operation wound slightly elevated. Ant. chamber almost empty. Pupil tolerably clear. Od. just seen, not excavated, Tn, Fn. Later news by letter indicates that eye remains subject to relapses of irritation.
61	Mich. Enscoe. 58. Good.	Ripe. Good.	August 19th. Reg. 14 days.	20/70	Disc. 6 weeks. 5 days.	20/30	
62	Sarah Use. 57. Good.	Ripe. Good.	August 20th. On 7th day she knocked her head against a wall. *Hyphema*.	5/70			

61	Mich. Enscoe. 58. Good.	Ripe. Good.	August 19th. Reg. 14 days.	$\frac{20}{70}$	Disc. 6 weeks. 5 days.		$\frac{20}{40}$	
62	Sarah Use. 57. Good.	Ripe. Good.	August 20th. On 7th day she knocked her head against a wall. *Hyphema.* No prolapse. Blood gradually absorbed. Pupil round and central. 27 days.	$\frac{20}{70}$				
63	Jer. Egan. 57.	Ripe. Good.	August 23d. Reg. 12 days.	$\frac{20}{60}$			$\frac{20}{30}$	In 3 weeks.
64	Louis Loos. 37. Good.	Ripe. Good.	September 3d. Reg. Capsule divided by a horizontal incision, by passing cystitome behind the upper part of the iris.	$\frac{20}{60}$			$\frac{20}{30}$	In 4 weeks. Capsule thin and even. Horizontal, superior cystotomy employed as a rule in the following cases.
65	Mrs. P. Ward. 57. Good.	Ripe. Corneal opacity.	September 3d. Reg. 15 days.	$\frac{20}{100}$	Disc. 18 days. 4 days.		$\frac{20}{40}$	Pupil and background clear.
66	Phil. Hardt. 49. Good.	Dislocated. Fair.	Sept. 18th. Extra. with capsule. Some *prolapse of vitreous.* No irritation. Recovery good. 21 days.	$\frac{20}{70}$				
67	Mrs. Sullan. 60. Good.	Ripe. Good.	Sept. 20th. Reg. 22 days.	$\frac{20}{200}$			$\frac{20}{40}$	In 2 months. Pupil and background perfectly clear.
68	Mary Bach. 69. Good.	Ripe, complicated, corn. opacities, and old trachoma.	Sept. 24th. Reg. 17 days.	$\frac{5}{200}$	Disc. 2 months. 5 days.		$\frac{20}{200}$	
69	Chr. Rettberg. 72. Good.	Ripe. Good.	Sept. 27th. Reg. 12 days.	$\frac{20}{70}$			$\frac{20}{30}$	In a month.
70	W. Lawrence. 55. Good.	Ripe. Thickened Capsule.	Oct. 3d. Reg. 14 days.	$\frac{5}{200}$	Disc. 4 weeks. 4 days.		$\frac{20}{40}$	
71	Ann Jones. 51. Good.	Ripe. Good.	Oct. 5th. Reg. 14 days.	$\frac{20}{100}$	Disk. 4 weeks. 4 days.		$\frac{20}{40}$	
72	Mary Colloran. 70. Good.	Ripe. Good.	Oct. 12th. Reg. 13 days.	$\frac{20}{70}$			$\frac{20}{30}$	
73	Mrs. McQuade. 60. Good.	Ripe. Good.	Oct. 14th. Reg. 14 days.	$\frac{20}{200}$				
74	Mr. N. Rose. 80. Good.	Ripe. Good.	Oct. 16th. Reg. 15 days.	$\frac{20}{30}$				
75	Ch. Schöttel. 70. Good.	Ripe. Good.	Oct. 16th. Reg. 14 days.	$\frac{5}{200}$				
76	Mrs. Wise. 55. Good.	Ripe. Good.	Oct. 18th. Reg. On 12th day fell down stairs. Slight bruises. Eye uninjured. 22 days.	$\frac{20}{60}$				
77	Cath. Travers. 71. Good.	Ripe. Good.	Oct. 23d. Reg. 17 days.	$\frac{20}{70}$	Disc. 16 days. 9 days.		$\frac{20}{30}$	

No.	Name, Age, Health.	Cataract; Eye.	Operation, Healing Process, Duration of Treatment.	Primary S.	Secondary Operation after Extraction, Duration of Treatment.	Ultimate S.	Remarks.
78	Mrs. Car. Valoroshi. 65.	Swollen by imbibition. Good.	Nov. 1st. Small prolapse of iris. No reaction. 15 days.	20/100			
79	Dr. McCaw. 66. Good.	Ripe. Good.	Nov. 2d. Reg. 15 days.	20/60	Disc. 20 days. 4 days.	20/20	
80	Mrs. Rowland. 70. Good.	Ripe, dacryocystit. chronic.	Nov. 4th. Op. healing of wound regular; the tear-sac carefully pressed out; the secretion, which by previous treatment had been reduced to a minimum, taken up with cotton, and junctival sac is washed out twice daily with corr. subl. 1 : 5,000. 20 days.	20/100			
81	Ther. Miller. 78. Good.	Ripe. Good.	Nov. 9th. Reg. 14 days.	20/70	Disc. 4 weeks. 3 days. And again 3 weeks later. 4 days.	20/70	Vitreous still cloudy. Pupil clear.
82	Jas. Mahone. 60. Good.	Hypermature. Good.	Nov. 11th. Reg. 21 days.	20/40	Disc. 5 weeks.	20/40	
83	Mrs. Coholan. 47.	Thickened capsule.	Nov. 12th. Extr. in capsule tried. Capsule broke. Lens expelled. Capsule drawn out with forceps. *Escape of a drop of vitreous.* Recovery without irritation. *Incarceration of iris.* 14 days.	20/40		20/60	4 weeks.
84	Jos. Heartley. 74. Good.	Ripe. Good.	Nov. 13th. Reg. 13 days.	20/70			
85	Mary Cleary. 60. Good.	Ripe. Good.	Nov. 15th. Reg. 15 days.	20/100	Disc. 4 weeks. 4 days.	20/70	In 4 days.
86	Leon. Bauer. 44. Good.	Ripe. Good.	Nov. 18th. Normal pupil until 5 days, when he hurt his eye with his finger. Small prolapse. No irritation. 18 days.	20/70		20/30	
87	Daisy Green. 19. Good.	Soft immature.	Nov. 20th. Disc. discharged 7th day. In 6 days returned with the ant. chamber filled with lens masses. $+T_1$. Regular extraction at once. Relief. Discharged in 10 days, with a round pupil and a good eye.	20/30		20/20	

			Discharged in 10 days, with a round pupil and a good eye.				
88	E. Miller. 69. Good.	Ripe. Good.	Nov. 23d. Reg. 18 days.	20/50		20/40	
89	Mrs. Hoggson. 54. Good.	Ripe. Good.	Nov. 30th. Reg. 15 days.	20/70	Disc. 4 weeks. 4 days.	20/30	4 months later still 20/20. Pupil and background clear as crystal. (Ideal result.)
90	Mary Donnelly. 55. Good.	Ripe. Perception of l. poor, especially in upper part of F.	Dec. 9th. Reg. 14 days.	20/100			Apparently better V. Patient's mind weak.
91	Carol. Kahn. 74. Good.	Ripe. Good.	Dec. 11th. Reg. 16 days.	20/200			
92	Mich. Schnidler. 67. Good.	Hypermat. Good.	Dec. 11th. Reg. 14 days.	20/100	Disc. 5 weeks. 4 days.	20/70	In four days.
93	Mrs. Mary Detz. 65. Good.	Ripe. Good.	Dec. 11th. Reg. 12 days.	20/100			
94	Mrs. A. Davis. 50. Good.	Hypermat. Good.	**1890.** Jan. 4th. Part of capsule removed with Schweigger's forceps. Moderate iritis. 17 days.	20/100	Disc. 5 weeks. A band remains in centre of pupil. 8 days.	20/30	
95	Mrs. Sullivan. 67. Good.	Morgagnian. Good.	Jan. 8th. Reg. 16 days.	20/200	Disc. 5 weeks. 4 days.	20/30 20/20	In 4 days. In 3 months.
96	Mrs. Wolfsburg. 64. Good.	Ripe. Good.	Jan. 17th. Severe pain 1st night. *Central prolapse.* 19 days.	20/40		20/40	June 1st. Prolapse free from irritation, gradually contracting. S. good.
97	S. Moffat. 69. Moderate.	Ripe. Good.	Jan. 17th. Reg. 18 days.	20/40			
98	John Smith. 62. Good.	Ripe. Good.	Jan. 20th. Reg. 14 days.	20/60			
99	Ferd. Baumer. 67. Good.	Ripe, thick, irregular capsule. Good.	Jan. 20th. Reg. 14 days.	20/200	Disc. 33 days. 11 days.	20/30	In 3 months. Large circular staphyloma post.
100	Jas. S. Smith. 53. Good.	Ripe. Good.	Jan. 24th. Pat. unruly, coughing, disturbing bandage. Pupil oval. No incarceration. 22 days.	20/200			

Anomalies during the Operation.

1) " *Breech delivery*," *i.e.*, lower part of lens turning up and escaping first, posterior surface turned toward the cornea, one case (7) result good.

2) *Extraction within capsule*, two cases (44), S $\frac{20}{70}$, floating opacities in vitreous; and (66) escape of vitreous. Recovery of good sight, $\frac{20}{70}$.

3) *Exit of lens through peripheric exsection of iris*, one case (51). Recovery smooth. S $\frac{20}{30}$.

4) *Anterior capsule drawn out*, two cases (59, 94), in the former, on third day, small prolapse of iris. Of late I have oftener extracted pieces of the anterior capsule and have seen it followed by prolapse of vitreous, probably because I tore the suspensory ligament of the lens.

5) *Escape of vitreous* occurred three times, namely, besides the above mentioned case 66, in case 55, after a laborious expulsion of the cataract through an insufficient section; recovery smooth, S $\frac{20}{40}$; and in case 83, in which extraction within capsule was tried, capsule broke; capsule drawn out with forceps after expulsion of lens; escape of a drop of vitreous; incarceration of iris. S $\frac{20}{50}$.

6) *Iris fell before the knife and was cut* in two cases, in case 51, as mentioned above, at 3), and in case 56. Recovery and sight good in both.

Anomalies of the Healing Process.

1) Cases of iritis have been rare since I discarded the central opening of the capsule, substituting for it the opening along the upper border of the lens (see above, p. 287). In a case of *severe iritis* (2) with traumatic prolapse of iris a pupillary membrane formed (S $\frac{1}{200}$). It was discinded in 6 months with S $\frac{20}{200}$. *Mild iritis*, 3 cases (25, 37, 94) are mentioned, doing no damage to vision. There was a goodly number with one or two small posterior adhesions, without inflammatory irritation worth mentioning. They had no influence on the clearing of the pupil either spontaneously, or by discission.

2) There were several cases of *secondary hemorrhage* into the anterior chamber, all traumatic, all without consequence.

3) *Permanent haziness of cornea*, from too much corrosive sublimate irrigation, two cases, reported above, p. 283.

4) *Death from pneumonia* in two cases, Nos. 4 and 42 (see p. 285).

5) *Glaucoma*, 3 cases. In one (60) it followed the extraction on the sixth day, and led to, or rather was a symptom of, protracted irritation. The other two occurred after subsequent cystotomy, and are spoken of below (p. 301).

6) *Prolapse and incarceration of the iris*, the *bête noire* of simple extraction, occurred in eight cases. They were as follows:

(2) Traumatic on 4th day, cut off a few hours later. Severe iritis. S = $\frac{1}{300}$. Disc. S = $\frac{20}{200}$.

(17) Traumatic, on 11th day. Cystoid wound. No irritation. $\frac{20}{70}$.

(33) Small, not protruding, seen on 4th day, cornea and ant. chamber hazy from too much corr. subl. irrigation (see above, p. 283.). S $\frac{1}{1000}$.

(41) Traumatic, small, 4th day, cut on 9th. $\frac{20}{60}$.

(53) Central, moderate, cornea saddle-shaped, no irritation, S $\frac{10}{300}$, optic-nerve atrophy.

(59) Small, 3d day, cut in 6 weeks. S $\frac{20}{50}$.

(83) Incarceration. No reaction, S $\frac{20}{50}$, without secondary operation.

(96) First night. No reaction, gradually contracting. S $\frac{20}{40}$.

This result is not so bad. There was no eye lost, and only one, No. 53, had a badly misshapen cornea, which might be improved by cutting the prolapse, but the result would be futile on account of the presence of optic-nerve atrophy.

There was no suppuration in this series of extractions without iridectomy, but there were three cases of it among the intercurrent operations, as was stated above. The one was the extraction of a secondary (shrunken) cataract, the two others were operations with iridectomy. I do not mean to introduce this as an argument against the combined method, but the experience gained from the present series of cases invalidates again the opinion, still held by many oculists, that the iridectomy diminishes the number of se-

vere inflammations, especially suppurations. My experience leads me to believe that just the opposite is true.

Visual Results.

Primary V.		Ultimate V.	
$\frac{20}{20}$	in 1 case	in	21 cases
$\frac{20}{30}$	" 5 cases	"	15 "
$\frac{20}{40}$	" 8 "	"	21 "
$\frac{20}{50}$	" 20 "	"	18 "
$\frac{20}{70}$	" 18 "	"	8 "
$\frac{20}{100}$	" 17 "	"	5 "
$\frac{20}{200}$	" 16 "	"	8 "
$\frac{18}{200}$	" 1 case		
$\frac{15}{200}$	" 2 cases	"	1 case
$\frac{12}{200}$	" 1 case		
$\frac{10}{200}$	" 1 "		
$\frac{6}{200}$	" 1 "	"	1 "
$\frac{5}{200}$	" 4 cases	"	1 "
$\frac{3}{200}$	" 4 "		
$\frac{1}{200}$	" 1 case	$\frac{1}{1000}$	
	100 cases		100 cases

The column of ultimate vision represents the results of the latest examinations, be they after or without a subsequent capsulotomy. I should mention that in 25 cases primary results only had been entered. Full visual acuteness was reached in 23 %, about as many as in the first series, less than in the second. Such variations may occur. They probably depend more on the greater or smaller number of complications than on differences in the operative procedure and the nursing, though I am far from underrating the effect of the latter. The difference is also owing to the smaller number of subsequent divisions of the capsule made in the third series, namely, 55, against 74 in the second series. Another difference worthy of mention is the fact that in the second series there was no case of full vision without a subsequent division of the capsule. In the third

there were six cases, one even as a primary result; in the five others a lesser primary acuteness rose to the full standard spontaneously.

Subsequent Cystotomy.

A secondary operation was made in 53 cases, a smaller number than before, but I am sure that many patients of this series will present themselves later to have their sight improved by a secondary operation. This operation consisted in each case in the splitting of the capsule with a knife-needle according to the method which I have followed for years and repeatedly described. None of these operations had a bad effect. In a few cases it led to inflammatory irritation (cyclo-hyalitis), which, however, yielded in each case, without impairment of vision. Glaucoma followed the discission in case 24 on the 8th day, but was cured by eserine instillations. In case 49 glaucoma developed five months after the discission. Not yielding to eserine a regular iridectomy upward was made. Viscid (healthy) vitreous escaped after the incision, proving that vitreous was in the anterior chamber. The patient was permanently cured.

The following table will show in what **degrees of visual acuteness discission was resorted to, and what were the visual results obtained:**

S

$\frac{2}{30}$, 1 case converted into $\frac{20}{30}$.

$\frac{20}{40}$, 2 cases " " $\frac{20}{30}$, $\frac{20}{20}$ respectively.

$\frac{20}{30}$, 11 " " " $\frac{20}{20}$ 6×, $\frac{20}{30}$ 2×, $\frac{20}{40}$ 2× $\frac{20}{50}$ 1×.

$\frac{20}{70}$, 11 " " " $\frac{20}{20}$ 4×, $\frac{20}{30}$ 1×, $\frac{20}{40}$ 3×, $\frac{20}{50}$ 2×, $\frac{20}{70}$ 1×.

$\frac{20}{100}$, 13 " " " $\frac{20}{20}$ 1×, $\frac{20}{30}$ 2×, $\frac{20}{40}$ 4×, $\frac{20}{50}$ 4×, $\frac{20}{70}$ 1×, $\frac{20}{100}$ 1×.

$\frac{20}{200}$, 9 " " " $\frac{20}{20}$ 2×, $\frac{20}{30}$ 3×, $\frac{20}{50}$ 2, × $\frac{20}{70}$ 1×, $\frac{20}{100}$ 1×

$\frac{18}{200}$, 1 case " " $\frac{20}{70}$.

$\frac{18}{200}$, 1 " " " $\frac{20}{40}$.

$\frac{10}{200}$, 1 " " " $\frac{20}{50}$.

$\frac{6}{200}$, 1 " " " $\frac{20}{200}$.

$\frac{3}{200}$, 1 " " " $\frac{20}{40}$.

$\frac{1}{200}$, 1 " " " $\frac{20}{200}$.

In all cases but one (where $\frac{20}{70}$ remained $\frac{20}{70}$) the operation increased the vision.

If we add the visual acuteness in the 53 cases before the discission and after it, we arrive at the aggregate gain of visual acuteness by the primary operation (extraction), the secondary operation (discission), and by both combined.

Primary vision of the 53 cases sums up to 12.95 full visions, which, at an average, gives each patient $\frac{1}{4}$ of the normal standard, *i.e.*, very near $\frac{20}{70}$.

After the secondary splitting of the capsule the aggregate visual acuteness of the 53 cases sums up to 32.53, *i.e.*, almost $\frac{20}{30}$ at an average. This result is really very gratifying, and may be expressed as follows:

The average visual result of extraction is $\frac{20}{70}$, which by subsequent cystotomy is converted into $\frac{20}{30}$.

This expresses, of course, only the experience of one operator. It remains to be seen how far it has general validity. Deducting the average primary result, $\frac{20}{70}$, from that obtained by the discission, $\frac{20}{30}$, we see that extraction gives the patient V $\frac{20}{70}$, and discission adds to it $\frac{20}{60}$—that is, more than he obtained by the extraction. The same result, computed in a similar way, was arrived at in my second series of 100 extractions.[1]

If we now arrange the ultimate visual results, as it is customary, in three categories, good, moderate, and failure, we have (see page 300):

Ultimate visual acuteness:

Perfect, 96 %, ranging from V $\frac{20}{20}$ to $\frac{20}{100}$.
Moderate, 3 %, " " " $\frac{15}{200}$ to $\frac{6}{200}$.
Failure, 1 %, movements of hand.

The present series emphatically upholds the conclusion I arrived at in the two preceding series, viz.:

Simple extraction is not only the best but also the safest method of removing cataract.

Facta loquuntur.

[1] These ARCHIVES, vol. xviii., pp. 10 and 11, 1889.

SYSTEMATIC REPORT ON THE PROGRESS OF OPHTHALMOLOGY DURING THE SECOND AND THIRD QUARTERS OF THE YEAR 1889.

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WITH THE CO-OPERATION OF

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Sections I.–V. Reviewed by Prof. H. MAGNUS.

I.—GENERAL OPHTHALMOLOGICAL LITERATURE.

TEXT-BOOKS, MONOGRAPHS, TREATISES ON GENERAL, BIBLIOGRAPHICAL, AND HISTORICAL SUBJECTS.

193. Danelius. Contribution to the ophthalmology of Aëtius. Inaug. Diss., Berlin, 1889. This dissertation contains the text of the vii. volume of Aëtius, which treats of ophthalmology, the *Βιβλια ἰατρικά*, with a translation. The remainder will soon appear.

194. Hirschberg. The ophthalmology of the ancient Egyptians. *Deutsche med. Monatschr.*, 1889, No. 38 fl. Presents a review of the ophthalmological knowledge of the Egyptians, with an explanation of the diseases mentioned in the papyrus Ebers, a translation of the chapter of which relating to eye diseases has just been published.

195. Instituto di clinica oculistica della R. Universita di Napoli. Anno scolastico, 1887–1888, Paria, 1889. Contains

papers on tuberculosis of the eye, on traumatic changes in the retina, and on capsular cataract, on optical degeneration of Krause's gland, on malignant neoplasm of the caruncle, on operations on the lids, on cataract-extraction, on intra- and extra-ocular cysticerci, on hyaline degeneration in scleral anterior staphyloma.

196. MÄLLER. Text-book of ophthalmology for veterinary surgeons. Stuttgart, 1889.

197. PAPYRUS EBERS. The measures and the chapter on eye-diseases. By Georg Ebers, Leipzig, 1889.

198. SCHMIDT-RIMPLER. Ophthalmology and ophthalmoscopy. For physicians and students. Fourth revised edition. Berlin, 1889. The first edition appeared in 1885; four have therefore appeared in not quite five years.

b.—STATISTICAL PAPERS.

199. BARDE. Hôpital ophtalmique à Genève. Sixth annual report, for the year 1888.

200. ILLINOIS CHARITABLE EYE AND EAR INFIRMARY, Chicago. Sixteenth annual report, 1889. Eye surgeons: Drs. Holmes, Hotz, Ware, Montgomery, and Gardiner.

201. MAGNUS. Report on the ophthalmic clinic of Prof. Magnus at Breslau for the year ending April 1, 1889.

202. SCHIESS-GEMUSEUS. Basel Ophthalmic Institute. Twenty-fifth annual report, for the year 1888. Basel, 1889.

203. SNELLEN. Dentigste Jaaresverslag van het Nederlandsch Gasthuis voor behoeftige en minvermogende ooglijders te Utrecht.

204. TRUC. Bulletin annuel de la clinique ophtalmologique de Montpellier. *Montpellier médic.*, 1889, No. 12; 1889, Nos. 1, 3, 5.

205. WESTHOFF. Kliniek voor Ooglijders. Amsterdam. Erste Jaarverslag voor, 1888. During the first six months 777 patients were treated.

BARDE (199) presents a report on the ophthalmic clinic at Geneva for the last 6 years. Of the 10,414 patients treated, 2,172 were admitted to the clinic. Among 206 extractions there were 12 without iridectomy; in two of the latter there was prolapse of the iris without harmful consequences. Hard and completely ripe cataracts may be extracted according to Barde without iri-

dectomy, or within the capsule. He thinks that the disadvantages of iridectomy have been greatly exaggerated, while the injurious consequences of prolapse of iris and of the secondary cataract, more common as the result of the operation without iridectomy, have been greatly underestimated. MARCKWORT.

During the two years 1887 and 1888 there were treated at the ILLINOIS CHARITABLE EYE AND EAR INFIRMARY (200) 6,398 patients. The important operations were: Extractions according to Graefe, 152; enucleations for various causes, 87; iridectomies, 167; operations on the muscles, 297, 65 of which were advancements. BURNETT.

MAGNUS (201) treated 4,005 patients in his dispensary. Extractions according to v. Graefe, 30, all successful; iridectomies 47; massage of the lens, 8; exenteration, 1; enucleations, 8; squint-operations, 27.

SCHIESS-GEMUSEUS (202) treated 2,162 patients in the dispensary, 540 in the in-door department. Extractions without iridectomy, 36, 34 with good, one with moderate result, one failure. Extractions with iridectomy, 37, 34 with good, two with moderate result, one failure. Two magnet operations, one exenteration, 40 squint-operations, 72 iridectomies.

SNELLEN'S (203) report is mainly devoted to the memory of Prof. Donders, to whom he pays a high tribute as the founder of instruction in ophthalmology, and as founder of the Nederlandsch Gasthuis voor behoeftige en minvermogende ooglijders te Utrecht. In 1888 3,037 patients were treated. WESTHOFF.

II.—GENERAL PATHOLOGY, DIAGNOSIS, AND THERAPEUTICS.

a.—GENERAL THERAPEUTICS.

206. BULL, C. S. The value of electro-therapeutics in lesions of the optic nerve. *N. Y. Med. Jour.*, April 27, 1889.

207. NUEL. Étude expérimentale sur les injections intra-oculaires. *Soc. franç. d'opht.*, Aug. 8, 1889.

208. POOLEY, T. R. The uses of an artificial eye-shell for operative and other purposes. *Amer. Jour. Ophth.*, Mar.-Apr., 1889.

209. WIDMARK. The influence of light on the anterior media of the eye. *Nord. med. Arkiv*, 1889, vol. xxi., 1. *Skandinavisches Arch. f. Physiol.*, vol. i. On the influence of light on the skin. *Biol. Fören. Handl.*, Apr., 1889.

In reporting to the N. Y. Academy of Medicine on the therapeutic value of electricity in lesions of the optic nerve, BULL (206) says: Up to within the last two years the reporter has employed the galvanic current in every case of optic-nerve lesion that has occurred in his private practice, and in many cases in hospital practice. His results were so negative and in many cases so unfavorable that for two years he has entirely given up galvanism as a method of treatment in these diseases. In traumatic anæsthesia of the optic nerve, without any lesion, however, some good sometimes comes from a careful use of electricity.

BURNETT.

NUEL (207) made experiments on the effect of injections upon the parts which line the anterior chamber. Injections of pure water caused a detachment of the endothelium of Descemet's membrane in one fourth to half a minute. The detached shreds fall into the anterior chamber and are absorbed. Injections of solutions of boracic acid are less harmful. Physiological solutions of salt are harmless, and may therefore be recommended to the adherents of injections into the anterior chamber after cataract operations. MARCKWORT.

POOLEY (208) has used very successfully the glass shield of Brière in keeping the globe and eyelids separated after detachment in symblepharon. No re-adhesions took place, and vision was very much improved. He also suggests the wearing of the shield over the cornea of the healthy eye in case of unilateral blennorrhœa of the conjunctiva. BURNETT.

WIDMARK (209) reports on the investigations which he made to determine the effect which sunlight and the arc-light may have upon the anterior media of the eye and upon the skin. Sunlight and the light of an electric lamp of 1,200-candle power produced a state of irritation in the eye of a rabbit, which in a marked degree resembled snow-blindness and the electric ophthalmia of man: chemosis and injection of the ocular conjunctiva, contraction of the pupil, change of color of the iris, haziness, and loss of epithelium of the cornea, and moderate secretion of the conjunctiva. The symptoms disappeared after two to four days. The question whether these symptoms are due to direct irritation of the anterior media of the eye, or to a reflex from the blinded retina, are solved in the following manner. A screen was placed before the rabbit's eye, with an aperture of *2 mm.* Through this aperture and the pupil the light fell upon the retina, the

other parts of the eye being protected against the light. In six such experiments the anterior media of the eye remained entirely unaffected. In six other experiments, in which the pupil and the retina were protected against the light, the above-mentioned symptoms, however, appeared, showing that the condition described depends upon the irritation of the anterior media of the eye, and not upon a reflex action from the blinded retina. Glass and quartz crystals are about equally permeable to the ultra-red and luminous rays, but differ from each other by the fact that glass absorbs the ultra-violet rays, while quartz crystals allow them to pass through. This difference was utilized in investigating which rays were the most effective. It was found that the light which had passed through glass, and therefore contained few ultra-violet rays, exerted scarcely any effect, while the light which had passed through the quartz crystal, and therefore contained many ultra-violet rays, produced severe irritation of the anterior media of the eye. Similar effects were produced upon the skin. The ultra-violet rays caused an affection like eczema solare et electricum, an erythema which remained for several days, and was followed by marked desquamation. The experiments also show that the ultra-violet rays possess the power of producing pathological changes upon the surface of the body when acting with sufficient intensity. SCHIÖTZ.

b.—GENERAL DIAGNOSIS.

210. ANGELL. On the use of atropine in the correction of optical defects by glasses. *Four. Ophth., Otol., and Laryng.*, vol. i., 1889.

211. CHISOLM, J. J. Needless and annoying restraints in eye-surgery. *Four. Amer. Med. Assoc.*, Aug. 17, 1889.

212. COLLINS. A simple improvement for specimens of eyes mounted for microscopical examination. *Ophth. Rev.*, vol. viii., p. 164.

213. GUILLSBRAND. En praktisk metod at bestämmer hornhinnuns astigmatism genom den s. k. denivelleringen af de oftalmometriska bilderna. *Nord. ophth. Tidsskr.*, vol. ii., No. 2, p. 93.

214. GROENOUW. Where lies the anterior boundary of the ophthalmoscopically visible fundus? *v. Graefe's Arch. f. Ophth.*, vol. xxxv., 3, p. 29.

215. NUEL et LEPLAT. Astigmatisme et ophtalmométrie. *Ann. d'ocul.*, vol. ci., p. 166.

216. PHILIPPS. The electro-magnet. *Jour. Ophth., Otol., and Laryng.*, Jan., 1889.

CHISOLM (211) returns to the discussion of the freedom to be allowed to eye-patients, particularly the subjects of cataract extraction. He does not, as a rule, even put his cataract patients to bed, and allows them the use of the eye not operated on. He, however, closes the lids of the eyes operated on with strips of isinglass plaster. BURNETT.

COLLINS (212) attaches a plano-convex lens to a half-open receptacle which contains the specimen.

GUILLSBRAND (213) reports the following: When a line is regarded through a doubly refracting prism, it is seen double as soon as it makes an angle with the doubling plane of the prism, denivellation. When an astigmatic cornea is examined with an ophthalmometer, with a straight line as object, no denivellation is observed in the two principal meridians, but in all others, and most markedly in those which form an angle of 45° with the principal meridians. In measuring the denivellation the astigmatism can be determined, and so the author has constructed upon this principle a little practical ophthalmometer which is held in the hand like an ophthalmoscope. It is to be had of Collin, Stockholm, price 75 kronen. SCHIÖTZ.

GROENOUW (214) finds that the anterior boundary of the ophthalmoscopically visible fundus lies 8.5 *mm* behind the corneal margin, in myopic eyes a little farther, in hyperopic a little nearer; in aphakial eyes this distance is reduced to 6.5 *mm*. We can see an area of the fundus equal to 770 to 800 times that of the papilla.

PHILIPPS (216) reports on three successful cases of extraction with the magnet. In case of failure he advises immediate enucleation.

c.—GENERAL PATHOLOGY.

217. CHIBRET. Bactériologie ophtalmologique. *Soc. d'opht. de Paris*, April, 1889.

CHIBRET (217) made experiments as to the presence of micrococcus aureus in the conjunctival sac and the injurious effect it may possibly have upon the healing of wounds. He comes to the conclusion that we must always be prepared for the presence of the micrococcus, but that its actual presence is quite compatible with the normal healing of a wound. MARCKWORT.

III.—INSTRUMENTS AND REMEDIES.

a.—REMEDIES.

218. DARIER. De la colchicine en thérapeutique oculaire. *Soc. franç. d'opht.*, Aug., 1889.

219. FELSER. On trichloroiodine. *St. Petersb. med. Wochenschr.*, 1889, No 3. Third Congress of Russian Physicians at St. Petersburg.

220. FOWLER. The use of phytolacca decandra in ophthalmic practice. *Jour. Ophth., Otol., and Laryng.*, Jan., 1889, vol. i.

221. GIBSON and TELKIN. A hitherto unobserved effect of the salicylates. *The Pract.*, 1889, p. 17.

222. KROLL. The curative action of cocaine. *Berliner klin. Wochenschr.*, 1889, No. 32.

223. PAUL. The antiseptic properties of saccharine in ophthalmology. In solutions of 1:250–500. *Deutsche med. Ztg.*, 1889, No. 2.

224. DE VRIESE. L'éphédrine et la pseudo-éphédrine. Nouveaux mydriatiques. *Ann. d'ocul.*, vol. ci., p. 182.

In obstinate cases of arthritic affections of the eye DARIER (218) recommends colchicine in granules of 2 mgrm., with an increase of the dose to 6 mgrm. It must however be discontinued should the intestinal canal become affected. Brunschwig saw disagreeable consequences after doses of ½ mgrm. (According to Ewald's pharmacopœia the dose should be 0.0006–0.003, one to three times daily.—Rev.) MARCKWORT.

FELSER (219) highly recommends trichloroiodine (ICl_3) as an antiseptic.

GIBSON (221) observed marked mydriasis with loss of reaction to light after the use of salicylate of sodium in doses of 1.2 grms, every two hours, eight hours after the first dose had been taken. The symptoms disappeared thirty hours after the last dose.

KROLL (222) recommends cocaine in five per cent. solutions in scrofulous blepharospasm, in episcleritis and iritis.

DE VRIESE (224) reports at length on experiments with ephedrine (derived from ephedra vulgaris varietas helvetica) and pseudo-ephedrine. These two alkaloids dilate the pupil, but do not paralyze the accommodation. As their effect disappears more rapidly than that of homatropine, these mydriatics are to be pre-

ferred to the latter for ophthalmoscopic examinations. Although ephedrine must be used in ten per cent. solutions its use is cheaper than that of homatropine. MARCKWORT.

b.—INSTRUMENTS.

225. DUANE, ALEXANDER. Some new tests for insufficiencies of the ocular muscles, together with a system of abbreviations suitable for note-taking. *N. Y. Med. Jour.*, Aug. 3, 1889.

226. LANDOLT. Objets types. Black letters on porcelain. *Soc. franç. d'opht.*, Aug. 9, 1889.

227. STAERR. A new (?) optometer. *Amer. Jour. Ophth.*, Mar.–Apr., 1889.

The tests described by DUANE (225) are not exactly new, but a new importance is attached to some old ones. The "screen test" for ocular muscular insufficiencies is modified, so that instead of watching the amount of deviation of the eye under the screen, the apparent movement of an object, a candle for instance, when the screen is removed, is noted. If there is insufficiency the image is shifted when the eyes are covered alternately, forming a sort of parallax, and the direction of the movement gives the muscles or set of muscles affected. The author claims great delicacy for this test. In testing for abduction and adduction he uses a small point which is moved from the centre to the periphery (right and left) of the field of fixation, and the place noted at which diplopia sets in. This is more readily accomplished by having the point stationary, and turning the head on its vertical axis. The table of abbreviations is quite lengthy, and most of them are well chosen. BURNETT.

IV.—ANATOMY.

a.—MALFORMATIONS AND EMBRYOLOGY.

228. GUNN. Congenital malformations of the eyeball and its appendages. *Ophth. Rev.*, July, 1889.

229. RANKE. The Mongolian eye as a temporary state in German children. *Neurol. Centralbl.*, 1889, No. 5; *Centralbl. f. prakt. Augenhk.*, 1889, p. 273.

GUNN (228) discusses the development of monolateral and bilateral anophthalmus, of cyclopia, cryptophthalmus, microphthalmus, buphthalmus, coloboma of the lids, and ptosis. WERNER.

RANKE (229) finds that the principal peculiarity of the Mongolian eye consists in a certain degree of epicanthus. In children of the Caucasian race a similar condition is observed, but it disappears in the course of years.

b.—SCLERA, CORNEA, IRIS, LENS, RETINA, OPTIC NERVE.

230. LEROY. Sur la forme de la cornée normale. *Acad. des Sciences. Sem. méd.*, 1888, pp. 42 and 45.

231. TORNATOLA. Direzione delle fibre dei nervi ottici nel chiasma. *Ann. di ottalm.*, vol. xviii., 3, p. 229.

LEROY (230) made accurate measurements of the surface of the normal cornea with his ophthalmometer and found that the vertical meridian had the same curvature in the upper and lower half, while in the horizontal meridian the curvature of the outer was different from that of the inner half. The curvature of the cornea depends to a great extent upon the ocular muscles.

MARCKWORT.

According to TORNATOLA (231), who has carefully examined three chiasmas in which one optic nerve was atrophic, distinct semi-decussation exists in man. Experiments on animals showed that in rabbits complete decussation takes place, while in dogs two thirds of the fibres of the optic nerve pass into the tractus of the other side, one third remaining on the same side. DANTONE.

V.—PHYSIOLOGY.

a.—RETINA AND CENTRAL ORGAN.

232. LJUBINSKI. On the influence of the electric light on the eyes of those engaged with it. *St. Petersb. med. Wochenschr.*, 1889, No. 3. Third Congress of Russian Physicians at St. Petersburg. *Centralbl. f. prakt. Augenhk.*, 1889, p. 176.

LJUBINSKI (232) found the continued action of the electric light produces attacks of pain, also lachrymation and photophobia, symptoms which mainly manifest themselves at night. The ophthalmoscope shows hyperæmia of the optic nerve; at the macula small plaques are observed.

b.—CORNEA, IRIS, MUSCLES.

233. AHRENS, R., and AHRENS, A. Further experiments on anisomorphous accommodation. *Zeh. klin. Monatsbl. f. Augenhk.*, 1849, p. 291.

234. CATANIA, ROMANO. Sur le striscie di filtrazione della cornea e dell' iride. *Boll d'ocul.*, vol. xi., 12–13, p. 89.

AHRENS (233) shows that the youthful eye is capable of obtaining clear images through cylindrical glasses, though the effort be continued through several minutes and gradually increased. This power is probably due to unequal muscular action at different points of the margin of the lens and consequent anisomorphous change in the lens.

ROMANO CATANIA (234), after numerous experiments on the filtration of colored liquids, which were injected into the anterior chamber, into the vitreous, or under the skin, has come to the following conclusions: (1) There are so-called filtration-bands in the cornea, which permit the aqueous humor to pass through, as Knies was the first to show; (2) the epithelium of Descemet's membrane permits of the passage of liquids, which however it checks and regulates; (3) in the iris no such bands exist, as Ulrich has assumed, the aqueous humor passing into the anterior chamber only through the pupil. DANTONE.

c.—COLOR-PERCEPTION.

235. SSAMUJLOW. The question of the exhaustion of the retina by different colors (red, green, blue). *St. Petersb. med. Wochenschr.*, 1889, No. 3. Third Congress of Russian Physicians at St. Petersburg.

According to SSAMUJLOW (235) the retina is most rapidly exhausted by red, less by green, still less by blue.

Sections VI.–XI. Reviewed by PROF. HORSTMANN.

VI.—ANOMALIES OF REFRACTION AND ACCOMMODATION.

236. BULL. Les variations de l'astigmatisme avec l'âge. *Soc. franç. d'opht.*, Aug. 8, 1889. The astigmatism does not change materially, either in childhood or in more advanced age.

237. v. HIPPEL. The influence of hygienic measures on school-myopia. Giessen, 1889.

238. KESSLER, H. M. C. Papilla falcata en papilla annullata. *Weekblad van het Nederlandsch Tijdschrift voor Geneeskunde*, 1889, Deel ii., p. 329.

239. LEROY. De la polyopie monoculaire. *Soc. franç. d'opht.*, Aug. 8, 1889.

240. MOTAIS. De l'hérédité de la myopie. *Arch. d'opht.*, 1889, No. 4, p. 321.

241. RANNEY, A. L. Eye-strain as a cause of headache and neuralgia. *N. Y. Med. Rec.*, June 22, 1889.

242. SCHMIDT-RIMPLER, H. Remarks on Stilling's paper; measurements of the orbit in different refractive conditions. *Fortschritte d. Med.*, 1889, No. 15.

243. SCHMIDT-RIMPLER, H. Once more the measurements of the orbit in different refractive conditions. *Fortschritte d. Med.*, 1889, No. 20.

244. SCIMENI. Sull' astigmatismo corneale in seguito ad estrazione di cateratta. *Ann. di ottalm.*, vol. xviii., 1–2, p. 147.

245. STILLING. Further orbital measurements of myopic and normal eyes. *Fortschritte d. Med.*, 1889, No. 17.

In the course of the last nine years v. HIPPEL (237) has regularly examined the eyes of the scholars of the high school at Giessen, and finds that a not inconsiderable part becomes myopic, while in others the already existing myopia increases, in spite of most perfect architectural construction and model interior equipments, in spite of the prevention of overburdening with work and regular medical control. He finds the cause on one hand in near-work *per se*, on the other in the unfavorable hygienic influences which act in the house upon the eyes of the children. The former cause of myopia can never be removed, unless we give up the fruits of modern civilization.

Stilling's investigations have shown that the terms "atrophy" and "conus" are not correct in myopia. KESSLER (238) therefore proposes a term based upon what one sees with the ophthalmoscope, *i. e.*, a papilla with a crescent (falx) and a papilla with a ring (annulus). At the Utrecht clinic the expressions "papilla falcata" and "papilla annullata" are used. For staphyloma posticum and sclerotico-choroiditis postica he would substitute ectasia (not sclerectasia) postica myopica. WESTHOFF.

LEROY (239) reports a case of monocular polyopia. Valude observed monocular polyopia in himself, and explains it from his myopia. Kalt made the same observation upon himself; he is emmetropic in one eye and has slight myopic astigmatism in the other. Kalt and Boucheron explain monocular polyopia by spasm of accommodation. MARCKWORT.

In order to study the influence of heredity upon the develop-

ment of myopia, MOTAIS (240) was not satisfied with making inquiries as to the vision of the relatives of his myopic patients, but examined the families themselves of 224 myopic boys and 106 girls, 330 families in all, including grandparents, parents, brothers and sisters, etc., in all 1,991 persons. After presenting a series of statistical tables Motais comes to the following conclusions: the heredity of myopia has been firmly established, and was found in 216 cases among 330 families (65 %). It descended from the father to the daughters in 86 %, from the mother to the sons in 79 %. When both parents were myopic the myopia descended with equal frequency to the sons and daughters. In myopia of the grandparents this crossing of the heredity was not so apparent. Omission of one generation was also observed: grandmother myopic, 2 sons not, 4 grandsons myopic, 4 grandchildren not; grandfather myopic, 3 daughters not, 4 among 5 granddaughters myopic. Myopia, when hereditary, appears at an earlier age, develops more rapidly, attains a higher degree, and is more frequently attended with intraocular changes than acquired myopia. Heredity is favored by taxing the eyes under unhygienic conditions (51 % instructed against 25 % uninstructed children of myopic families), by astigmatism (14 % above 0.75 D), and by flattening of the orbit (30 %). V. MITTELSTÄDT.

In this paper RANNEY (241) again takes up the subject of eye-strain as a cause of headache, and tabulates fifty consecutive cases of headache and neuralgia treated exclusively for the correction of eye-strains. Of course great attention is given to the disturbance in the equilibrium of the external muscles or "heterophoria," since the author is a firm believer in this as a cause of various pathological nervous conditions. The histories of all the fifty tabulated cases are given in greater or less detail, and seem to bear out the claims of the author as to the efficacy of the treatment, whether by glasses or by graduated tenotomies of the muscles. BURNETT.

SCHMIDT-RIMPLER (242) opposes the hypothesis of Stilling, that a low, broad orbit can be the cause of the development of myopia. According to his measurements and investigations, the school-myopia in cases of low orbit had not increased more in three and a half years than in cases of high orbit. In the majority of cases it is impossible to determine from the shape of the orbit whether a scholar in the lower classes will become myopic or not in the course of his studies.

SCIMENI (244) concludes from numerous measurements of the cornea before and after cataract extractions that the operation can cause astigmatism or increase it if it already exists. In one case, which he particularly mentions, the error had increased from 1 D to 18 D. He believes that the cause of the change of curvature is to be found, not only in the manner of healing of the wound, as has thus far always been assumed, but also and particularly in the pressure which the internal and external rectus muscles exert upon the globe, which on account of the escape of the aqueous has been partially deprived of its power of resistance. This is the reason why the greater curvature is found in the meridian parallel to the section. DANTONE.

STILLING (245) presents the results of orbital measurements of 810 persons, mostly students; they confirm his opinion previously expressed, that a low, broad orbit predisposes to myopia.

VII.—LIDS.

246. CERESETO. Ectropion della palpebra inferiore. Nuova applicazione di un vecchio metodo operatorio. *Boll. d'ocul.*, vol. ix., 9, p. 68; and *Gaz. med. di Torino*, vol. xl., 15, p. 337.

247. CHEVALLEREAU. Corps étranger ayant sejourné dix ans dans paupière supérieure. *Soc. d'opht. de Paris*, April 2, 1889.

248. LAGRANGE, F. Anatomie pathologique et pathogénie du chalazion. *Arch. d'opht.*, 1889, No. 3, p. 226.

249. LESZYNSKY, W. M. Bilateral blepharospasm, with divergent strabismus, cured after division of the external rectus muscle. Subsequent restoration of stereoscopic vision. *N. Y. Med. Jour.*, May 18, 1889.

250. MILLINGEN, E. VAN. Remarks on one hundred cases of trichiasis, operated on according to my method of so-called tarsachelioplasty. *Centrabl. f. prakt. Augenhk.*, 1889, p. 193.

251. NOYES, H. D. An operation for some extreme cases of ectropium of the upper lid. *Amer. Jour. Ophth.*, 1889, No. 8, p. 245.

252. PEUNOW, A. J. Two cases of transplantation of excised pieces of skin in plastic operations on the lids. *Sitzungs-Protokoll d. Kaukas. med. Gesellsch.*, vol. xxvi., No. 2.

253. RUTTLE, R. Rare form of ankyloblepharon. *Brit. Med. Jour.*, Sept. 14, 1889, p. 599.

254. SCIMENI. Sulla margino-plastica palpebrale nella trichiasi e nell' entropio. *Boll. d'ocul.*, vol. xi., 12–13, p. 85.

255. SPANGENBERG, A. A case of tuberculosis of the lids and eye. *Inaug. Diss.*, Marburg, 1889.

256. STELLWAG VON CARION. Review of the attempts at transplantation in ophthalmology, and a new case of transplantation of mucous membrane. *Allgem. Wiener med. Ztg.*, 1889, Nos. 27, 28, and 29.

257. ST. VALUDE. Du blepharospasme. Etiologie et traitement. *Arch. d'opht.*, 1889, No. 3, p. 273.

258. VALUDE, E. De la restauration des paupières, désavantages de la greffe cutanée. *Arch. d'opht.*, 1889, No. 4, p. 289; No. 5, p. 394.

259. VAN DUYSE. Sarcome de la paupière. *Ann. d'ocul.*, vol. ci., p. 227.

260. VIGNES. Epicanthus héréditaire. *Soc. d'opht. de Paris*, June 4, 1889.

In an operation for ectropium, CERESETO (246) took a flap from the inner side of the upper arm to cover the large defect, as the old Italian surgeons did in rhinoplasty, and was well satisfied with the result. DANTONE.

CHEVALLEREAU (247) removed from the left upper lid of a patient a piece of glass which had been concealed therein for ten years without causing any irritation, the patient himself not being aware that a foreign body had remained behind after the injury. A month before its removal he had had frequent headaches. At the same time a little elevation appeared in the skin just above the external canthus; at this point Chevallereau extracted the triangular piece of glass, one side measuring 10 *mm*, the other two 23 *mm*. MARCKWORT.

LAGRANGE (248) examined fifteen chalazia, some of them removed with the fibrous capsule and the adjacent cartilage. He assumes three stages of development: retention of the contents of the Meibomian glands, adenitis, and periadenitis, with destruction of the cartilage and development of the tumor towards the conjunctiva or the outer surface of the lid. The contents consist of granulation tissue and broken-down epithelium; the latter contains micrococci, which however play only a secondary part. He did not find any giant-cells. In most cases there was a fibrous capsule, sometimes, especially in fresh cases, it was wanting.

v. MITTELSTÄDT.

LESZYNSKY'S (249) patient, a boy of fourteen, was affected with bilateral clonic blepharospasm, since an attack of scarlatina when six years old, which left him with a divergent strabismus of the left eye. Left eye myopia $\frac{1}{7}$, and astigmatism $\frac{1}{60}$. $V = \frac{20}{70}$—. The left external rectus was divided, and the ametropia corrected. Binocular vision was restored. BURNETT.

MILLINGEN (250) found that after the performance of the tarso-cheiloplasty devised by him the pannus cleared up, and the superficial ulcers accompanying cicatricial trachoma rapidly healed.

In cases where the upper lid is so contracted that there is undue pressure on the eyeball, NOYES (251) cuts through the conjunctiva, tarsus, and orbicularis from the free to the upper edge of the tarsus, leaving the bridge of skin above the wound. The wound is allowed to heal without interference.

BURNETT.

PEUNOW (252) covered the defects caused by the excision of a tumor and a cicatrix with pieces of skin, 3 *cm* wide, which in one case he took from the forearm of the patient himself, in the second from the forearm of the son of the patient, the pieces being of the whole thickness of the skin. The results were very satisfactory. Peunow ascribes the success (1) to the strict antisepsis of the bandage and the avoidance of strong antiseptics in manipulating the flap and the defect; (2) to the transfer of the pieces in their entire thickness; (3) to the careful freshening of the edges and surface of the defect; (4) to the accurate adaptation of the piece of skin; and (5) to the complete arrest of bleeding. HIRSCHMANN.

RUTTLE (253) observed a case in which the lids of both eyes had been congenitally united at the inner side by an elastic, skin-like membrane. They were divided without difficulty.

WERNER.

The method of operating for entropium in cases of highly degenerated tarsus proposed by SCIMENI (254) is a modification of that of Burchardt. After dividing the edge of the lid and forming a rectangle in the skin of the lid the short sides of this rectangle are not detached at the two canthi, but the whole strip of skin is drawn across the ciliary margin and inserted in the intermarginal space, the ciliary margin having been previously detached at the outer ends and attached with sutures to the upper edge of the incision. The strip is maintained in position by a bandage without the aid of sutures. In twelve among fifteen cases

operated on according to this method the bridge of skin became attached in its whole extent, in three a small part sloughed away in the middle of the lid and was replaced by cicatricial tissue.

DANTONE.

SPANGENBERG (255) observed a case of tuberculosis of the lids in a boy aged fourteen. The lids of the right eye were reddened, infiltrated with nodules, and ulcerous; the eyeball had been converted into a nodular, brownish-red tumor. The diseased parts of the lids and the eyeball were removed and proved to be tuberculous. The disease first appeared in the skin of the lids, whence it spread to the conjunctiva, cornea, sclera, and inner parts of the eye. The microscope and cultures demonstrated the existence of tuberculosis. Tubercle bacilli were shown to be present.

ST. VALUDE (257) briefly discusses the causes and treatment of the usual forms of blepharospasm, and calls attention to the fact that not only hysteria, but also forms of psychic disease can be the cause. He saw a man who had suffered for eight years with clonic blepharospasm, who, though otherwise healthy, was affected with hereditary taint on both the father's and mother's side, and who had stuttered since youth and was always troubled without cause about his future. At one time the orbicularis was divided, but without success. The author warns against operative procedures in cases of purely nervous blepharospasm, as they are absolutely useless. They only come into consideration when the disease is of a distinct reflex nature. V. MITTELSTÄDT.

After a brief discussion of the various methods of blepharoplasty VALUDE (258) expresses himself against the transplantation of flaps without a pedicle as a general method. He thinks it is applicable only in a very limited number of cases. He shows in two cases of cicatricial ectropium after burns, that although the flaps had taken hold, they completely disappeared after a few months by absorption, making the operation a failure, while in another case a very good result was obtained with a pedunculated flap which had been transplanted to a similarly injured lid. He presents a review of seventy-five cases of transplantation of a flap without a pedicle, the results of which he thinks were published too soon, and yet only fifteen among them were successful, indicating that this method is not generally applicable. According to Valude the method of operation should be chosen on the following principles: 1. When the scars are confined to the lids and cause partial or complete ectropium, pedunculated or sliding flaps should be chosen. He then describes the different procedures

for the various kinds of ectropium. 2. When the lids and neighborhood consist of non-adherent cicatricial tissue, flaps without a pedicle are not advisable; the best results are obtained with pedunculated flaps when they consist of vascular cicatricial tissue; in low degrees a sliding flap is sufficient. 3. When the ectropium is surrounded by cicatricial tissue which cannot be used for plastic purposes, flaps without a pedicle may be tried, though the result is uncertain. The old Italian method, formerly used in rhinoplasty, is well suited for this purpose, when the patient is willing and the operator is familiar with the method. 4. In cases in which the defect in the lid is not due to ectropium, but to the removal of a cancer, flaps with or without a pedicle may be employed as no retraction of the surrounding tissue is to be feared; the method of Thiersch, especially, is to be commended. It is very easy and well adapted for cases in which the defect is situated at one of the canthi (report of a case). In cases of cancer the wound may also be covered when it begins to granulate, a procedure well suited for the observation of relapses. The defect need not be covered for a long time, especially when it is a large one, as the neighboring skin will partly cover the defect spontaneously, thus making a less extensive secondary plastic operation necessary, as shown by a case of Verneuil reported by the author.

V. MITTELSTÄDT.

VAN DUYSE (259) presents a few more details in regard to a previously published case of sarcoma of the lid. The prognosis of this disease is very bad. An early and extensive operation must be performed, so that at least the whole lid must be sacrificed.

MARCKWORT.

VIGNES (260) operated on a man aged thirty-six for bilateral epicanthus, complicated with narrow palpebral fissure, ptosis, and pyramidal cataract. Epicanthus of more or less marked degree was observed in many members of the family. As early as 1845 Sichel found epicanthus and ptosis in the grandfather of the patient. Vignes observed the same abnormity in the man's children.

MARCKWORT.

VIII.—LACHRYMAL APPARATUS.

261. NOYES. Entrance of an eyelash into the inferior canaliculus. *Am. Jour. Ophth.*, Aug., 1889.

262. SGROSSO. Sul cilindroma e sul cancro melanico della caruncula lagrimale. *Ann. di ottalm.*, vol. xviii., 1–2, p. 57.

263. WESTHOFF. Adeno-carcinoma glandulæ lagrymalis. *Kliniek voor Ooglijders*, 1889, p. 8.

NOYES (261) found a fine eyelash with its point sticking in the lower canaliculus and its body rubbing against the eyeball and giving rise to much irritation. The reviewer has seen one such case. BURNETT.

SGROSSO (262) describes two small tumors of the caruncle, one of which proved to be a cylindroma, the other a melanotic sarcoma. According to his statement no case of cylindroma of the caruncle has thus far been observed. DANTONE.

WESTHOFF (263) removed the lachrymal gland, which was larger than a hen's egg, from a woman aged sixty-three, with preservation of vision. Twenty-five years ago the left eye received a blow, and since that time it had protruded more and more, so that now it stands 10 *mm* lower and 20 *mm* farther forward than the right. The eyeball is freely movable in every direction. The choroid around the optic nerve is markedly atrophic from the tension on the nerve. WESTHOFF.

IX.—MUSCLES AND NERVES.

264. BEARD, C. H. Advancement with but a single suture. *Amer. Jour. Ophth.*, March–April, 1889.

265. GAST, R. A. A case of bilateral congenital ophthalmoplegia. *Zeh. klin. Monatsbl.*, vol. xxvii., p. 214.

266. GÜNSBURG, F. Report of cases of congenital anomalies of the muscles. *Zeh. klin. Monatsbl.*,vol. xxvii., p. 263.

267. HUBBELL, A. A. Cases of ocular paralysis. *Buffalo Med and. Surg. Jour.*, Sept., 1889.

268. LANDMANN, O. On cycloplegia post-diphtheritica. *Amer. Jour. Ophth.*, May, 1889.

269. MÜLLER, C. E. Contribution to the etiology and operation of convergent strabismus. *Inaug. Diss.*, Marburg, 1889.

270. PETERS, A. On paralysis of convergence. *Centralbl. f. prakt. Augenhk.*, 1889, p. 225.

271. WRIGHT, J. W. Rheumatism of the ocular muscles. *N. Y. Med. Rec.*, Sept. 28, 1889.

BEARD'S (264) modification of the advancement operation is as follows: The conjunctiva is dissected off the muscle, and the latter is loosened from its attachment to the eyeball up to its in-

sertion near the cornea. A thread is armed with two needles, one of which is passed through the upper edge of the tendon, the other through the lower edge, thus leaving a loop of thread on the upper side of the tendon. The tendon is then cut about 2 *mm* in front of the stitch. The stump of tendon remaining is then cut off close to the sclera. The upper needle is then run through and under the conjunctiva to a point above the vertical diameter of the cornea, and the lower thread is run similarly below. One of the needles is then brought back and passed through the loop of the thread on the top of the tendon, and the two ends are drawn until the tendon is advanced to the desired point and then tied. BURNETT.

GAST (265) observed in a woman aged thirty-three complete immobility of both eyeballs, with normal power of accommodation and almost normal sight.

GÜNSBURG (266) reports the complete absence of any action of the external rectus in a grandmother, father, and two daughters, while a third daughter had alternating divergent strabismus.

HUBBELL (267) reports a case of paralysis of both facial and both abducent nerves following injury. After discussing the various causes that might lead to such a result, he concludes that it can be best accounted for on the supposition of a hemorrhage near the median line of the floor of the fourth ventricle between and affecting the nuclei of the abducent and the nuclei of the facial nerves. He also relates the history of a case of total monocular ophthalmoplegia externa and interna also from injury (the "punch" of an umbrella-stick in the eye). Vision was entirely lost, the optic disc was pale, and the retinal vessels were slightly reduced in size. BURNETT.

LANDMANN (268) thinks that in the majority of cases of cycloplegia sine iridoplegia the paralysis is due to the perverted state of the blood influencing the nutrition of the muscle and not the nerve-centre or nerve-endings. BURNETT.

MÜLLER (269) has compiled 154 cases of convergent strabismus from the material of the Marburg ophthalmic clinic, arranging them according to age and refraction. In seventy-eight per cent. there was H in both or at least one eye, in twelve per cent. there was E in both, in five per cent. M in both; he calls attention, however, to the fact that even in cases in which at present M or E exists there may have been H at the time the strabismus developed. He also reports cases of spontaneous cure of strabismus,

the H persisting. The primary effect of the operation must be measured very carefully; subsequent exercises with the stereoscope and stimulation of the "desire of binocular fixation," as Schmidt-Rimpler expresses it, are very important. Of seventy-seven patients with divergent strabismus sixty-four per cent had myopia in one or both eyes.

PETERS (270) reports two cases of paralysis of convergence, the one the consequence of an injury, the cause of the other unknown. The subjective symptoms consisted principally in dizziness and diplopia. When an object in the median line is intently regarded, the pupil does not respond, and the eyeballs remain immovable. The affection is of central origin.

WRIGHT (271) thinks that many of the intractable head-pains from which so many suffer, are due to some form of rheumatism of the ocular muscles, and that it should be looked for in such cases. BURNETT.

X.—ORBIT AND NEIGHBORING CAVITIES.

272. ALT, A. Orbital sarcoma in children. *Amer. Jour. Opht.*, Feb., 1889.

273. AHRENS, R. Another case of cavernous tumor of the orbit. *Zeh. klin. Monatsbl. f. Augenhk.*, vol. xxvii., p. 416.

274. BENSON. Aneurism in the right orbit cured by digital compression. *Br. Med. Jour.*, 1889, p. 716.

275. BRUNSCHWIG. Angiome caverneux encapsulé de l'orbite. *Arch. d'opht.*, 1889, No. 5, p. 419.

276. HALTENHOFF. Exophtalmie congénitale syphilitique. *Ann. d'ocul.*, vol. cii., p. 108.

277. JEAFFRESON, C. S. A record of sixteen cases of orbital tumor. *Lancet*, July 20, 1889, p. 110.

278. VALUDE. Kyste hydatique de l'orbite. *Rec. d'opht.*, 1889, No. 8, p. 486.

ALT (272) reports two cases of sarcoma of the orbit in children on whom he operated. In the first, the mother had a sarcoma of the axilla, and other members of the family had died of cancer. An attempt was made to enucleate the tumor and save the eyeball, but it was not successful. The tumor, which was the size of a hazel-nut, grew from the main wall of the orbit. The child was one and a half years old. A few days after the operation the child died of erysipelas. The tumor was found to be a round-

celled sarcoma. Second case: boy aged two years. The whole contents of the orbit were removed. The tumor, which was a round-celled sarcoma with portions of a myxomatous character, occupied the outer upper portion of the orbit. There was a return of the growth in six weeks, and as there were cerebral symptoms nothing further was undertaken. BURNETT.

The case of AHRENS (273) was one of cavernoma of the orbit. The tumor was 2 *cm* long and 11 *mm* thick, and was removed, with preservation of the globe.

BENSON (274) relates a case of orbital aneurism in a man aged thirty-eight. The disease began two months after a blow with a stick. No thrill could be felt, nor was there any visible pulsation of the globe. At the outer side of the upper cul-de-sac of the conjunctiva there was a collection of dark, tortuous veins, and the veins in the retina were darker and fuller than those in the other eye. The patient was cured by digital compression of the carotid. WERNER.

BRUNSCHWIG (275) removed from an otherwise healthy woman of thirty-two, a cavernous angioma which had developed in the left orbit in the course of eight years. When first examined there was only moderate exophthalmus of the left eye, but no diagnosis could be made, as all the symptoms characteristic of a cavernous tumor were absent. As there were no indications of a malignant growth, a lipoma was thought to be the cause. Five years later the eye protruded still more, and although a soft, incompressible tumor could be felt in the upper inner part of the orbit, an exact diagnosis was impossible. Mobility perfect, no limitation of the visual field, no diplopia, no pain. An incision was made at the lower outer margin of the orbit, and the tumor removed. It proved to be an encapsuled cavernoma, which had developed outside the funnel of muscles. Sight and the ophthalmoscopic condition, which had not been materially affected before the operation, remained unchanged, and only paralysis of the superior oblique resulted, which may necessitate an operation. Two illustrations show the condition of the patient before and after the operation. V. MITTELSTÄDT.

HALTENHOFF (276) observed marked exophthalmus in a newborn child, which he ascribed to a gumma of the orbit. The eyeball protruded about 1 *cm*, and deviated slightly downward and outward. In endeavoring to reduce it a firm resistance was encountered. Inunctions with blue ointment were made twice

daily, and iodide of potassium was given internally, whereupon the exophthalmus completely disappeared. In an older sister congenital syphilis was undoubtedly shown to exist. MARCKWORT.

JEAFFRESON (277) records 16 cases illustrating the following classes of orbital growths: (1) growths originating in the orbital tissue unconnected with the eyeball; (2) those arising from the periosteum or bony walls; (3) those commencing in the neighboring cavities; and (4) those due to vascular disease in the cavity of the orbit and closely adjoining part of the cranium. Among the latter was a case of teleangiectasia of the orbit, which was removed successfully along with the globe in spite of alarming hemorrhage; also a blood-cyst of the orbit, which occurred during a fit of whooping-cough, and was cured by puncture with trocar; and finally a pulsating tumor, for which the common carotid was ligated with fatal result. WERNER.

VALUDE (278) found during an operation an echinococcus-cyst of the orbit instead of the dermoid cyst he had expected. It contained much chloride of sodium, but no hooks could be found. The sac was easily removed by traction with the forceps. Healing by first intention. Valude advises always to remove such cysts. Meyer remarks that these cysts are usually much larger than the one operated on by Valude; the patients, however, generally do not present themselves until the cysts have begun to suppurate. MARCKWORT.

XI.—CONJUNCTIVA, CORNEA, SCLERA, ANTERIOR CHAMBER.

279. ABADIE. Symblépharon rébelle guéri par transplantation d'un lambeau de muqueuse buccale. *Soc. d'opht. de Paris*, April 2, 1889.

280. ALT, A. On pterygium. *Amer. Jour. Ophth.*, March–April, 1889.

281. BASEVI. Il micrococco della congiuntivite folliculare. *Ann d'ocul.*, vol. ci., p. 159.

282. BURCHARDT. The galvano-caustic treatment of follicular conjunctivitis. *Deutsche militärärztl. Zeitschr.*, 1889, No. 4.

283. GASPARINI. Innesto di congiuntiva e cornea di cane in un caso di simblefaron con attecchimento immediato e successiva atrofia. *Ann. di ottalm.*, vol., xviii., 3, p. 204.

284. GIOTTI. Contributo alla cura della congiuntivite granulosa. *Boll. de scienze med.*, vol. xl., 1, p. 21.

285. HOWE, LUCIEN. The purulent conjunctivitis of infants, and blindness in the State of New York. *N. Y. Med. Jour.*, May 4, 1889.

286. NUEL et LEPLAT. Conjonctivite folliculaire. *Ann. d'ocul.*, vol. ci., p. 159.

287. PECHDO. Phlegmon spontané de l'œil ; resorption purulente. *Soc. franç. d'opht.*, August 13, 1889.

288. PFALZ, G. The operative treatment of follicular conjunctivitis. Bonn, 1889.

289. SCHRÖDER, TH. The surgical treatment of chronic follicular trachoma. Results of removing the granulations with a metallic brush. *Wratsch*, 1889, No. 34.

290. SWART, ABRAHAMSZ. Restoration of the conjunctiva with scales of epidermis. *Kliniek voor Ooglijders*, 1889, p. 12.

291. TOSI. Cura della congiuntivite granulosa colle scarificazioni associate alla cauterizzatione. *Giorn. med. del R. Esercito e Marina*, vol. xxxvii., 4, p. 363.

292. TROUSSEAU. Lupus et tuberculose oculaire. *Soc. franç d'opht.*, August 8, 1889.

293. VOSSIUS. A. The practical value of the operative treatment of follicular conjunctivitis. *Therap. Monatsh.*, 1889, Nos. 6, 7.

In a case of symblepharon ABADIE (279) successfully transplanted mucous membrane from the lips. The eye had been destroyed by combustion with lime, and the stump had become united with the lower lid in such a manner as to obliterate the lower conjunctival sac and make the wearing of an artificial eye impossible. Abadie took a flap ½ *cm* long and 1 *cm* wide from the inner surface of the upper lip and covered the defect on the inner surface of the lid with it. MARCKWORT.

ALT (280) thinks that for the formation of pterygium we must have first a loss of substance at the corneal margin, secondly, a microbe which grows slowly into the corneal tissue, and thirdly, a small fold of conjunctiva dragged upon the cornea by the continued progress of microscopical death and attempted repair in the corneal tissue. The operation he prefers is that of excision, drawing the dissected conjunctiva over the wound and cauterizing the cut surface with pure carbolic acid. The after-treatment is antiseptic. BURNETT.

Basevi (281) has obtained from cultures of the secretion of follicular conjunctivitis on gelatine and agar-agar a very small, round coccus, with motion of its own, which differs materially from the diplococci of trachoma and conjunctival catarrh. When introduced under the conjunctiva of animals (monkeys, dogs, rabbits, pigeons), it produces a condition very similar to that of follicular conjunctivitis in man. Dantone.

Burchardt (282) employed the galvano-cautery in follicular conjunctivitis with good result. He destroyed from 30 to 40 follicles at one sitting, and repeated this after 5 or 6 days. The patients were cured in from 3 to 4 weeks.

Gasparini (283) describes an operation for symblepharon due to combustion with lime. After the adhesions had been divided the wound was covered with conjunctiva and a small piece of cornea taken from a hunting-dog.

Giotti (284) reports that in 30 cases of trachoma he tried the scarifications recommended by Abadie and followed by cauterization with sulphate of copper in glycerine (1:8) with excellent result. Dantone.

Howe (285) finds, by an examination of the statistics, that blindness in the State of New York (as well as in other parts of the country) is increasing nearly eight times as rapidly in proportion as the population. More than 20 % of this blindness is caused by the purulent conjunctivitis of infants. He thinks the State should interfere and control the management of such cases in their incipiency, by legislation, as is done in some countries in Europe. He adopts the Credé method, or some modification of it, as the most efficient. Burnett.

In trachoma Pfalz (288) recommends excision of both cul-de-sacs with a strip of tarsus. He incises the fornix close to the canthus and separates it from the ocular and palpebral conjunctiva close to the edge of the tarsus. He then cuts it out as far as the opposite canthus. The width of the piece of mucous membrane thus excised varies between 5 and 8 *mm.* The operation is done both upon the upper and lower lid. The edges of the wound are united with sutures. The result in 70 eyes thus treated was satisfactory.

Schröder (289) uses a brush of nickelled-silvered copper wire, with which he removes all the visible trachoma follicles from the conjunctiva, and even the pannous cornea, under cocaine, and in one sitting, if possible. He finds this method more satisfac-

tory and easier than other surgical procedures, and suitable even for out-door patients. The wounds caused by the instrument heal rapidly and easily, leaving only smooth scars. The patients are improved. In some cases, however, he observed relapses.

HIRSCHMANN.

SWART ABRAHAMSZ (290) observed a man into whose eye a piece of glowing iron had entered 16 years ago, causing symblepharon. After it had been divided, the upper lid was everted, and the ciliary margin attached to the skin of the brow with three sutures. He then cleansed the wound and waited until the bleeding had ceased. Then little scales of epidermis, which had previously been abscised from the arm and placed in 0.6 % sterilized solution of salt, were laid like shingles upon the wound and both eyes bandaged. Several scales took hold. In a second operation a few scales were transplanted upon the ocular conjunctiva. The result of these two operations was very satisfactory.

WESTHOFF.

TOSI (291) remembers that the scarifications with subsequent cauterization with sulphate of copper, as recommended by Abadie and now by Giotti, were proposed and frequently performed by Ubandi 25 years ago. DANTONE.

TROUSSEAU (292) scraped a little off a conjunctiva affected with lupus, and experimented upon rabbits with it, introducing it in 2 cases into the corneal tissue and in 2 into the anterior chamber. In 3 of them he obtained positive results, as tubercles developed in the eye. Inoculation of the cornea is more difficult than inoculation in the anterior chamber; the iris in particular is very susceptible. MARCKWORT.

VOSSIUS (293) obtained good results in trachoma by excising the fornix. He recommends numerous sutures, however, in closing the wound, so as to prevent the growth of granulation-tissue.

294. FUCHS, E. Keratitis punctata superficialis. *Wiener klin. Wochenschr.*, 1889, No. 44.

295. GOTTSCHALK, J. Ulcus corneæ rodens. *Inaug. Diss.*, Bonn, 1889.

296. HIRSCHBERG, J. Keratitis in congenital syphilis. *Centralbl. f. prakt. Augenhk.*, 1889, p. 201.

297. LEPLAT. Sur la pathologie de la cornée. *Gaz. méd. de Liège*, 1889, p. 445.

298. Rosmini. Ancora nella cheratoplastica mediante inneste della cornea di coniglio. Quarta lettera al Prof. Gradenigo. *Boll d'ocul.*, vol. xi., 10–11, p. 73.

299. Secondi, G. Le iniezioni sottocongiuntivali di sublimato corrosivo per la cura delle alterazioni infettive della cornea. *Boll. d'ocul.*, vol. xi., 15–16, p. 115.

300. Walker, E. On the treatment of some of the grave diseases of the cornea. *Liverpool Med.-Chir. Jour.*, July, 1889.

301. de Wecker. Greffe cornéenne. *Soc. d'opht. de Paris*, May 7, 1889.

302. Williams, R. On three cases of conical cornea treated by the actual cautery. *Brit. Med. Jour.*, Feb. 23, 1889.

Stellwag, Adler, and v. Reuss have described keratitis punctata superficialis, which was first observed in Vienna. As the descriptions of these authors differed, however, Fuchs (294) has published his experience in 36 cases. The disease begins with the symptoms of an acute conjunctivitis with marked ciliary injection and profuse lachrymation, attended with photophobia and pain. After a few days small gray dots appear, sometimes in small, sometimes in large numbers, irregularly scattered over the cornea or principally near the centre. They lie in the superficial layers and raise the epithelium. The symptoms of irritation soon disappear, but the dots generally remain unchanged for months, and then slowly disappear. The disease, which Fuchs calls "keratitis punctata superficialis," most frequently attacks young people, and begins ordinarily with acute rhinitis and a cough. It closely resembles herpes corneæ febrilis, on account of the arrangement and location of the dots, but differs from it by the absence of vesicles in the face. Vesicles never occur upon the cornea, and very seldom loss of epithelium and ulcers.

Gottschalk (295) describes two cases of rodent corneal ulcer. He recommends treatment with the galvano-cautery.

According to Hirschberg (296), keratitis due to congenital syphilis always leaves blood-vessels in the cornea and generally also patches in the fundus.

Rosmini (298) transplanted a disc of rabbit's cornea into a leucomatous eye according to Hippel's method. For six days all went well. The disc became attached and remained clear; the patient declared after the removal of the bandage that she had seen the face and even the eye-glass of the operator. She did

not remain quiet however after this, and disregarded the rules observed during the first days. In consequence the disc lost its transparency and came away after twenty-four hours. The eye was destroyed by panophthalmitis. DANTONE.

SECONDI (299) reports on the excellent results obtained at the Turin clinic with subconjunctival injections of sublimate. Solutions of 1:2,000, 1:5,000, and 1:10,000 were used, and the good effect sometimes was apparent within twenty-four hours, especially in purulent keratitis. The same method was also tried in endocular diseases with encouraging result, especially in syphilitic affections, and the author thinks the method has a great future.

DANTONE.

WALKER (300) recommends peritomy in severe corneal ulcers. His results were good. WERNER.

DE WECKER (301) performed transplantation of a rabbit's cornea according to Hippel's method, and then covered the eyeball with a glass shell which had previously been accurately fitted. The transplanted disc took hold, and through it could be seen what had been left of the human cornea, which unfortunately consisted of cicatricial tissue with adherent remnants of iris, so that no improvement of vision was obtained. De Wecker particularly calls attention to the good healing under the glass shell.

303. HERN, J. Notes of a case of sclerotitis apparently of dental origin. *Brit. Med. Jour.*, 1889, No. 1500, p. 698.

304. RAMPOLDI. Brevi considerazioni cliniche intorno a un caso di sclero-coroidite anteriore. *Ann. di ottalm.*, vol. xvii., 6, p. 544.

305. WALLSTABE, C. Contribution to the treatment of partial scleral staphyloma with the galvano-cautery. *Inaug. Diss.*, Greifswald, 1889.

HERN'S (303) patient, an otherwise healthy woman, æt. thirty-eight, experienced suddenly paroxysmal pain over the left infra-orbital region and towards the left eye. A patch of sclerotitis with corneal haze was observed at the lower, outer portion of the eye, which did not get well until after the removal of a carious upper bicuspid on the left side. WERNER.

RAMPOLDI (304) discusses a case of sclero-choroiditis anterior with advanced glaucomatous symptoms in a girl aged fourteen, whose mother suffered with gout. As no other cause could be found for the affection of the eye, the author is inclined to

seek it in an hereditary arthritic diathesis, of which he had seen an analogous example in a young man a few years previously.

DANTONE.

WALLSTABE (305) recommends the repeated application of the glowing platinum wire in incipient traumatic scleral staphyloma.

Sections XII.–XXI. Reviewed by DR. P. SILEX.

XII.—IRIS.

306. ANDREWS, J. A. Primary sarcoma of the iris. *N. Y. Med. Jour.*, June 1, 1889.

307. BJERRUM. Et tilfalde af let iridocyclitis med. spontan arteriepuls in Art. centr. ret. *Nord. ophth. Tidsskrift*, vol. ii., 1, p. 23, Copenhagen, 1889.

308. HIRSCHBERG, J. Tuberculous tumor of the iris. *Berlin. med. Gesellsch., München. med. Wochenschr.*, 1889, No. 22; *Deutsche med. Wochenschr.*, No. 23; *Allg. med. Centralztg.*, No. 50.

309. MCKEOWN, DAVID. Blind for sixty years. Iridectomy. Recovery of sight and of perception of color. *Memorabilia*, No. 7, p. 417.

310. LEPLAT. De l'iridocyclite chez les vieillards. *Ann. de la Soc. méd.-chir. de Liège*, 1889.

311. NOVELLI. Nota di un caso di riduzione d'ernia dell' iride. *Boll. d'ocul.*, vol. xi., 7, p. 49.

312. PARISOTTI. Iniezione di calomelano nella cura della sifilide oculare. *Boll. d. Soc. Lancisiana*, 1889.

313. STEFFEN, W. Fibrosarcoma of the globe in a child one and three quarter years old. *Jahrb. f. Kinderhk.*, vol. xxx., 1–2, p. 110.

ANDREWS' (306) case was that of a woman of forty-seven, who had noticed a discoloration of the iris at the site of the tumor for five or six years. Periodical obscurations of vision and injection frequent since that time. The tumor was excised with a piece of the iris by Dr. C. R. Agnew. A week afterwards the eye was enucleated, a general infection being feared. The patient was alive at last accounts. In addition to this case Andrews gives a short account of all the cases of a similar kind that have been reported, twenty-five in number. Most of the tumors seem to have originated in the anterior portion of the iris. In several cases sight was preserved after the removal of the tumor. BURNETT.

BJERRUM (307) reports a case of slight iridocyclitis in both eyes, in which all the arteries in the left eye showed an undulating pulsation on the papilla ; it presented the appearance of the ordinary venous pulse. SCHIÖTZ.

HIRSCHBERG (308) presented a child eighteen months with apex-catarrh, upon whose iris a reddish-yellow tumor with numerous small nodules had developed. As an injury and syphilis could be excluded the diagnosis of tuberculosis was made. On October 23d he reported to the Medical Society that the eyeball had been removed, and that the well-known anatomical structure of the tubercle had been found, but no tubercle-bacilli.

LEPLAT (310) discusses several cases of iridocyclitis in older people which he had observed. The symptoms were generally as follows : ciliary injection, deposit on Descemet's membrane, discoloration of the iris, and more or less numerous posterior synechiæ, much reduced V, and T about + 1. In such cases great care must be exercised in the use of atropine when T is increased. They take the most favorable course under the following treatment : eserine, and, if necessary, puncture combined with subcutaneous injections of pilocarpine. (The Reviewer obtained good results from repeated instillations of pilocarpine into the conjunctival sac). Leplat also takes occasion to recommend the instillations of iodide of potassium in ocular diseases in which it is not borne by the stomach. [After I had seen this method of treatment recommended by Schweigger (*cfr. Arch. f. Augenhk.*, vol. xvii., p. 141), I have also used it frequently.—Rev.]

MARCKWORT.

NOVELLI (311) describes the successful reposition of a small hernia of the iris, which had existed less than twenty-four hours, and was the result of the perforation of a peripheral corneal ulcer.

DANTONE.

In four cases of severe syphilitic iritis PARISOTTI (312) tried the subcutaneous injections of calomel and obtained surprising results : in twenty-four to forty-eight hours all the acute symptoms had disappeared. The author made the injection, not like other Italian colleagues in repeated doses of 10 cgr. at the temple, but in a single dose of 30 cgr. at the nates of the patients. The remedy, however, failed to remove the residues of an old keratitis parenchymatosa. DANTONE.

In STEFFEN'S (313) patient the fibrosarcoma sprang from the ciliary body, produced metastasis in the orbit, broke through pos-

teriorly, and enveloped the greater part of the optic nerve. Numerous hemorrhages were found in the tumor. There were no metastases in other organs. The disease had lasted six months. The case is also remarkable on account of numerous hemorrhages under the cranial bones and marked rhachitic changes in the latter.

XIII.—CHOROID.

314. CHIBRET. Du curage antiseptique de l'œil dans la panophtalmie. *Rev. génér. d'opht.*, 1889, No. 5.

315. DEMME. Contributions to the knowledge of tuberculosis in childhood. Twenty-fifth med. report on the Jenner children's hospital at Berne, 1888.

316. GAYET. Sur un cas d'adénome de la choroide. (With illustrations.) *Arch. d'opht.*, vol. ix., No. 3, p. 205.

317. HIRSCHBERG, J. Incipient panophthalmitis with cystoid scar cured. *Centralbl. f. prakt. Augenhk.*, 1889, vol. xiii., p. 267.

318. TAILOR. Sulla tuberculosi cronica del globo oculare. *Ann. di ottalm.*, vol. xviii., 1–2, p. 76.

CHIBRET (314) describes a new operation which he performs in panophthalmitis. As soon as the diagnosis has been made, he operates as quickly as possible in the following manner: with Graefe's knife a large corneal flap is made downward, and the iris, pupillary exudations, and anterior capsule of the lens are extensively torn with the point of the knife, whereupon the lens escapes with the pus. Lukewarm antiseptic fluid (Hg_2OCy 1:1000) is then injected in various directions into the globe with an Anel syringe with a large canula, so that the suppurating part may be separated from the healthy, the latter remaining behind and being preserved, as Chibret maintains. The fluid last injected remains in the globe. The patients treated in this manner left the clinic three to six days after the operation. Chibret operated on five of them according to this method. In two of the cases Chibret estimated the stump which formed at two thirds of the size of the normal eye, in one at one half, of the other two he says nothing. (For cosmetic purposes such stumps are almost worthless, and they probably shrink in the course of time. An artificial eye, properly fitted, moves well without a stump; the latter is frequently irritated by the shell, while after an enucleation this is not possible. Whether the stump after Chibret's operation

can give rise to sympathetic ophthalmia the future must show, as he himself correctly remarks. The patients however are to be pitied who must pay for this experience with the loss of the other eye.—Rev. MARCKWORT.

DEMME (247) reports on eighty-seven cases of miliary tuberculosis in children, in forty-nine of which it could be traced to primary tuberculous affection of the viscera, and in thirty-eight to a primary peripheric location. In nineteen he found tubercles in the choroid. In a blacksmith, thirty years old, without any hereditary taint, who four years previously had had attacks of fever in Cheyenne without particularly affecting his health, GAYET (316) observed a tumor of the choroid, which had been flattened to the shape of a lentil and touched the optic nerve with the outer side. The tumor presented the structure of tubular glands; on cross-section it appeared marbled and pitted. The tubules, which seemed to have no membrana propria, were lined with cylinder-epithelium and contained granular cells with one or more nuclei. No inflammatory reaction was observable in the neighborhood of the tubules, which seemed to follow the course of the obliterated blood-vessels. The eye had become blind from detachment of the retina, and was very painful. This condition led to a careful general examination, which revealed the existence of carcinoma of the stomach. The cachectic patient soon died. Besides the carcinoma of the stomach several nodules were found in the liver. The author considers the choroidal tumor as secondary, an opinion which is supported by the similarity of its structure to that of the glands of the stomach. He thinks that choroidal tumors must be considered secondary growths more frequently than formerly. v. MITTELSTÄDT.

HIRSCHBERG (317) recommends the removal of the masses containing the microbes of suppuration by extracting them if movable, and burning them off when they are firmly united with the membranes of the eye.

TAILOR (318) describes two cases of tuberculosis of the eye-ball, which was observed in girls aged seven and twenty-two respectively. The first was especially interesting, because the diagnosis of tuberculous neoplasm to the exclusion of glioma and sarcoma could only be made with the microscope, and because the tumor had partly perforated the sclera, partly had distended it considerably, and was covered with it as with a fibrous capsule. DANTONE.

XIV.—GLAUCOMA.

319. Dürr and Schlegdendal. Five cases of hydrophthalmus congenitus. *Graefe's Arch.*, vol. xxxv., 2, p. 89.

320. Hirschberg, J. Almost absolute glaucoma in gummous iritis cured by iridectomy. *Centralbl. f. prakt. Augenhk.*, vol. xiii., p. 266.

321. Hutchinson, J. Introduction to a discussion on the treatment of glaucoma. *Ann. Meeting Brit. Med. Assoc.*, Aug., 1889.

322. Krückow, A. Remarks on glaucoma based on the statistics of 1,430 cases. *Wjestnik Ophth.*, July–Oct., 1889.

323. Laqueur, L. On glaucoma in young persons. *Arch. f. Augenhk.*, vol. xxi., 1, p. 91.

324. Mittermaier. On the occurrence of glaucoma in cataractous eyes. *Inaug. Diss.*, Heidelberg, 1889.

325. Priestley-Smith. Erasmus Wilson lectures on the pathology of glaucoma. (Forty-eight illustrations.) *Brit. Med. Jour.*, Apr., pp. 757, 817, 880, 929.

Dürr and Schlegdendal (319) present a very detailed description of the anatomical condition of five hydrophthalmic eyeballs, which showed great differences according to the complications. In one well-marked case they found partly old, partly fresh traces of inflammation at the sclero-corneal junction, also at the insertion of the iris, and signs of periphlebitis on the choroid, absence of Schlemm's canal to a great extent, obstruction of the anterior ciliary veins, almost total absence of the circular fibres of the ciliary muscle, atrophy of the iris, choroid, and retina, deep glaucomatous excavation and loosening of the dural sheath of the optic nerve. They also give very acccurate measurements of the insertions of the muscles, their width, and of the position of the varicose veins. The superior oblique muscle shows the peculiarity of a broad, transverse insertion, causing a depression. This insertion resembles that found by Stilling in many myopic eyes. The veins had a suprachoroidal sinus, which is supposed to be due to the peculiar form of attachment of the muscles and the compression of the veins at their exit depending upon it. No signs of inflammation were found in the choroid, as assumed by Birnbacher and Czermak as the cause of the dilatation of the veins. Finally a compilation of twenty

cases of hydrophthalmus is given, in which the changes found in the different parts are discussed. According to the authors hydrophthalmus is a secondary glaucoma, the beginning of which must be sought in an intra-uterine inflammation of the choroid. In extra-uterine life venous stasis follows, the cause of which must be sought in the muscular pressure on the veins. In a patient suffering with gummous iritis of the right eye, with marked increase of tension, HIRSCHBERG (320) performed an iridectomy, whereupon the tension again became normal. As to the result of this discussion, which was introduced by JONATHAN HUTCHINSON (321), it was agreed on all hands that iridectomy was the most successful treatment for acute glaucoma. As to chronic glaucoma, opinions were of course divided, but the majority approved of iridectomy, and considered it superior to sclerotomy. Little could not corroborate the statement that iridectomy tends to further contract the field of vision, and advocated the operation in the early or premonitory stage. Frost had had an eye lost by intraocular hemorrhage after an early operation, and hence does not interfere until the field begins to shrink. Mules recommends a very small iridectomy upwards, to be followed by a very large sclerotomy three days later. Berry alluded to the scarcity of glaucoma in Scotland, a fact which Hill Griffith thought might be due to the relative infrequency of gout in that country. Swan Burnett observed that the black race, free as it was from trachoma and other eye diseases, had its full share of chronic glaucoma. Pilocarpine, on the whole, was considered preferable to eserine.

WERNER.

KRÜCKOW (322) disproves the opinion of Bonwetsch that the Slavs are more disposed to glaucoma than other European nations. Based on his statistics, Krückow also opposes the opinion that hypermetropia predisposes to glaucoma. There were among his glaucoma patients 28 % with emmetropia, 26.78 % with myopia, and 43.18 % with hypermetropia. The preponderance of glaucoma patients with hypermetropia he ascribes to the greater frequency of hypermetropia in itself. The greatest number of glaucoma cases is observed between the ages of fifty and seventy-five. Sex made no material difference. The right and left eye were affected with equal frequency. The time elapsing between the affection of the first and second eye varied up to fifteen years. In one case the other eye was still healthy after seventeen years.

HIRSCHMANN.

MITTERMAIER (324) has compiled twenty-one cases, among them five from the Heidelberg clinic, in which glaucoma was observed in cataractous eyes, and comes to the following conclusions: In aging eyes primary glaucoma often develops with cataract. A connection between the two has not been proven. Aphakia does not protect against glaucoma, not even when an iridectomy is performed at the time, or as a preliminary operation. When the operation was irregular, or complications set in in the course of healing, the glaucoma is but secondary. If this is not the case, primary glaucoma developing later resembles those cases in which an iridectomy produced only a temporary improvement, and had to be repeated.

PRIESTLEY-SMITH (325) discusses at great length, in three lectures, based on original investigations, the whole question of the pathology of glaucoma. In Lecture I. the author draws attention to the fact that increased tension, which is the essence of the disease, is frequently intermittent, and may even be absent for long periods of time. To understand the morbid process, we must study first the normal intraocular pressure and the processes by which it is maintained; secondly, the causes which lead to an excess of pressure; and thirdly, the consequences of such excess.

Under the first head the principles of tonometry, and the secretion and escape of aqueous fluid, are treated of and summarized as follows: The fluids which nourish the vitreous body and lens and fill the aqueous chamber are secreted by the ciliary portion of the uveal tract. The larger part of the secretion passes directly into the aqueous chamber, forwards through the pupil, and out at the filtration-angle. A very much smaller portion passes backwards through the vitreous body, and escapes at the papilla. The hyaloid membrane and zonula which separate the two chambers are readily permeable by the vitreous fluid. The pressure which the fluid exerts against the walls of the chambers is equal to about 25 *mm* of mercury, and is the same, or nearly so, in both chambers. Lecture II. first treats of the physical and physiological experiments bearing on increased tension; a modification of Birnbacher and Czermak's apparatus is described and figured. Of the causes which may give rise to glaucoma—viz.: hypersecretion of the ciliary processes, obstruction at the filtration-angle, and serosity of the fluids, the second one is in the author's opinion the most important. Among seventy or more eyes examined, representing various forms of glaucoma, only

three failed to show compression of the filtration-angle. When this sign is present without glaucoma, the fluid finds an abnormal outlet, *e.g.*, through a diseased cornea, or else the ciliary processes are atrophied or damaged, and secretion is arrested. On the other hand, serosity of the fluids of the eye may give rise to increased tension without obstruction of the filtration-angle, as in serous iritis. The closure of the filtration-angle is a cause of the high pressure, and not a consequence of the latter, in cases of annular posterior synechiæ, perforating wounds and ulcers of the cornea, dislocations and injuries of the lens, and in intraocular tumors which produce secondary glaucoma. A case of glaucoma after cataract-extraction is described, in which puncture of the membrane in the coloboma resulted in a gush of fluid from behind, and the eye recovered its normal tension. Numerous illustrations of eyes which suffered from secondary glaucoma accompany the paper.

Lecture III. The author is thoroughly convinced, after examining twenty-five specimens of primary glaucoma, that in all cases the ciliary processes press against the base of the iris, and thereby close the filtration-angle. Birnbacher and Czermak's observations (*v. Graefe's Arch.*, vol. xxxii., p. 1) are unreliable, both as regards material and method. As regards predisposing causes, there is a parallelism between the increasing liability to glaucoma and the increasing size of the lens which accords well with the supposition that a diminished circumlental space predisposes to the disease. The smallness of the cornea in glaucomatous eyes is another point in favor of this view. Having measured a large number of healthy and glaucomatous eyes, twenty-eight persons were found to have small corneas, and among these twenty-eight twenty had glaucoma. Microphthalmic eyes with healthy lenses are also prone to glaucoma. Excessive size or prominence of the ciliary region may also tend to diminish the circumlental space, *e.g.*, Fuchs' case (*v. Graefe's Arch.*, vol. xxx., 3, p. 123). Phlebitis of the vertex veins has been described as a cause, but the author has found these changes in the veins in cases of secondary glaucoma where they were certainly not the initial causes of the disease. Treatment by eserine is not only useless but injurious if it does not contract the pupil, as it increases hyperæmia. It is better to use the weakest solution which will contract the pupil, and it should be combined with cocaine. WERNER.

XV.—SYMPATHETIC OPHTHALMIA.

326. ABADIE. Des diverses formes cliniques de l'ophtalmie sympathique. *Soc. franç. d'opht.*, Aug. 9, 1889.

ABADIE (326) distinguishes two kinds of sympathetic ophthalmia: (1) The infectious, the existence of which has been proven by Deutschmann beyond doubt, and which takes its way through the optic nerve. In this form the optic nerve and its surroundings are first affected; the vitreous next becomes cloudy, and finally the uveal tract becomes diseased, especially the iris. In this form the focus of infection in the primarily affected eye must be treated with the galvano-cautery, and eventually the anterior chamber must be emptied. Mercurial treatment is decidedly indicated. If no improvement thereupon takes place in the other eye, enucleation must be resorted to. (2) The reflex form, which is transmitted through the ciliary nerves. For the treatment of this form, the existence of which has not been positively proven, Abadie recommends sclerotomy, which divides the ciliary nerves between the wound and the nerve-centre. According to Wecker, surgical procedures in traumatic cataract must be especially feared on account of sympathetic ophthalmia. Panas considers enucleation very good prophylactic treatment. After the disease has developed, however, mercurial treatment gives the best results. Dransart also did not observe any improvement from enucleation after sympathetic ophthalmia had once developed; he therefore removes, as a prophylactic measure, every eye irretrievably ruined by an injury. Reymond obtained good results in sympathetic ophthalmia with subconjunctival injections of sublimate (1:2,000 to 500). Nuël found in eyes which had caused the disease only staphylococcus albus and aureus.

MARCKWORT.

XVI.—LENS.

327. ABADIE. De certaines complications qui surviennent quelques jours après l'opération de la cataracte. Pathogénie. Traitement. *Ann. d'ocul.*, vol ci., p. 179.

328. AYRES, S. C. Extraction of cataract without iridectomy, or simple extraction. *Amer. Jour. Ophth.*, May, 1889.

329. BAUDON. Note sur les résultats obtenus dans cent quarante opérations de cataracte. Short report on 140 cataract operations (partly extractions, partly divisions), with 13 failures. *Rec. d'opht.*, No. 7, p. 395.

330. BLANCH. Quelle est la meilleure méthode d'extraction de la cataracte? *Rec. d'opht.*, 1889, No. 8, p. 460.

331. CRITCHETT. Address delivered at the opening of the Section of Ophthalmology. *Brit. Med. Jour.*, Aug. 24, 1889, p. 414.

332. DESPAGNET. De l'extraction du cristallin luxé. *Soc. d'opht. de Paris*, May 7, 1889.

333. FAGE, A. Contribution à l'étude des hemorrhagies intra-oculaires consécutives à l'extraction de la cataracte. Examen histologique. *Arch. d'opht.*, 1889, vol. ix., No. 4, p. 351.

334. GALEZOWSKI. Quelques mots sur l'extraction de la cataracte et sur l'application dans quelques cas d'iridectomie. *Soc. d'opht. de Paris*, July 2, 1889.

335. GRAEFE, A. Continued report on the results of cataract extractions under antiseptic precautions. *v. Graefe's Arch.*, vol. xxv., 3, p. 249.

336. GUNN. Note on the action of the aqueous on lenticular substance. *Ophth. Rev.*, vol. viii., p. 235.

337. HIRSCHBERG, J. On cataract operations and diabetic senile cataract. *Deutsche Med. Wochenschr.*, 1889, No. 37.

338. KAZAUROW, J. The question of operating for cataract by aspiration. *Wjestnik Ophth.*, July–October, 1889.

339. KOLINSKI, J. The action of naphthaline upon the eye and the so-called naphthaline cataract. *v. Graefe's Arch.*, vol. xxxv., 2, p. 29.

340. LAWRENTJEW, L. K. Report on a third hundred of cataract extractions. *Wjestnik Ophth.*, May–June, 1889.

341. MARTIN, E. La suture de la cornée dans l' opération de la cataracte. *Rec. d'opht.*, 1889, No. 5, p. 265.

342. NICOLINI. Sulla maturazione artificiale della cataratta. *Boll. d'ocul.*, vol. xi., 15–16, p. 105.

343. PANAS. L' action thérapeutique de l'antipyrine dans la glycosurie. *Arch. d'opht.*, vol. ix., No. 3, p. 265.

344. PARISOTTI. Sulla maturazione artificiale della cataratta. *Rif. Med.*, Jan., 1889.

345. RISLEY, T. D. Incipient cataract; its etiology, treatment, and prognosis. *University Med. Magazine*, Mar., 1889.

346. SCHIES. Report on 1,100 cataract operations. *Schweizer Correspondenzbl.*, 1889, No. 15, p. 461.

347. STEFFAN, PH. Further experiences and studies on cataract extraction, 1882–1888. Antiseptics and technique. *v. Graefe's Arch. f. Ophth.*, vol. XXXV., 2, p. 171.

348. SUAREZ DE MENDOZA. Suture de la cornée dans l'opération de la cataracte. *Rec. d'opht.*, 1889, No. 9, p. 523, and *Soc. franç. d'opht.*, Aug. 8.

349. TEALE, A. Discussion on the treatment of immature cataract. *Brit. Med. Jour.*, Sept. 28, 1889, p. 694.

350. THORN, H. On suppuration after cataract extraction. *Inaug. Diss.*, Greifswald, 1889.

351. DE WECKER. L'avenir de l'extraction de la cataracte. *Ann. d'ocul.*, vol. ci., p. 221.

352. DE WECKER. Remaniement du procédé classique de l'extraction simple. *Soc. franç. d'opht.*, Aug. 8, 1889.

353. WICHERKIEWICZ, BOL. The most suitable method of opening the capsule for cataract extraction. *Klin. Monatsbl. f. Augenhk.*, vol. xxvii., p. 169.

354. WICHERKIEWICZ. Instruments pour l'opération de la cataracte. *Soc. franç. d'opht.*, Aug. 8, 1889.

ABADIE (327) believes that the symptoms of inflammation suddenly appearing 5 or 6 days after a successful extraction are due to infection, the development of which was delayed for a while by the antiseptics used. He advises cauterizing the wound in such cases with the galvano-cautery. MARCKWORT.

In the 32 cases of simple extraction done by AYRES (328), there was one failure, due to injury inflicted by the patient himself. On the whole the author is favorably impressed with the operation. BURNETT.

BLANCH (330) extracts cataracts without irridectomy and opens the capsule with the Graefe knife according to Galezowski, immediately after the puncture. The corneal incision lies in the limbus a little above the horizontal diameter, and the height of the flap is about 2—2½ *mm* from the edge. The knife is the only instrument introduced into the eye. On the basis of his own experience he is strongly opposed to washing out the anterior chamber. MARCKWORT.

DESPAGNET (332) describes the successful extraction of a dislocated lens with a broad spatula. Trousseau extracted 13 dislocated lenses with Taylor's loop; he makes a small corneal

section. Gillet de Grandmont also recommends the extraction of dislocated lenses, but with a large corneal section. (Any one who has extracted according to Pagenstecher hypermature or otherwise suitable cataracts within the capsule will be surprised at still seeing so many oculists hesitate about extracting a dislocated lens, provided it is not dislocated to such an extent that it cannot be seized with the spoon, or when severe complications exist. Rev.) MARCKWORT.

FAGE (333) reports on a case of intraocular hemorrhage after extraction with iridectomy, observed at Badal's clinic. The cataract was not complicated, and there was no myopia or increase of tension. The patient, a man aged fifty-nine, was free from any diathesis, no atheroma or heart-disease (whether a bleeder is not mentioned. Rev.), had only slight bronchitis, and cough. He had scarcely gone to bed, whither he had slowly walked, as is customary in Badal's clinic, when he felt the hemorrhage, which lasted several days, in spite of cold applications and a compressive bandage. The eye was enucleated on the twelfth day, after panophthalmitis had developed, when a large bloodclot was found between the choroid and retina. The hemorrhage, therefore, probably came from the choroid, the arteries, of which, however, did not show any fatty or atheromatous changes. The author was unable to discover the cause of the hemorrhage.

v. MITTELSTÄDT.

GALEZOWSKI (334) again discusses his method of extracting cataracts, and once more recommends his gelatine tablets for covering the wound. Iridectomy he advises in the following cases: (1) Where the iris falls before the knife; (2) in synechiæ; (3) when the corneal wound is too small; (4) in capsular cataract; (5) in subluxation of the lens; (6) in constitutional cataract (glycosuria, albuminuria); (7) in syphilis. Parent adds to this in the discussion, cases of increased tension. The discussion had reference mainly to the time when the first bandage should be changed. Galezowski changes it for the first time on the sixth day; Parinaud after 24 hours, on account of the incarceration so frequent in extraction without iridectomy. In such a case he performs iridectomy a day after the extraction, which at a later period is no longer possible. Despagnet does not change the bandage for a week, in order to prevent hernias of the iris due to re-opening of the wound. During the first 24 hours he irrigates the bandage with a saturated solution of boracic acid,

thus making it firm by crystallization within it. Valude does not change the bandage for 3 or 4 days. Gutierrez Tome recommends the glass shells which adapt themselves to the eye; DESPAGNET is opposed to them, as, according to his experience, simple closing of the lids is sufficient to break them.

MARCKWORT.

GRAEFE (335) lost only 0.93 per cent. from suppuration among 1,074 extractions in which he used the antiseptic precautions described in *Graefe's Arch.*, vol. xxx., 4, p. 217. From this he concludes that we must expect the best results, not from technique, as Steffan assumes (*v. Graefe's Arch.*, vol. xxxv., 2), but from asepsis and antisepsis. The inundations of the eye with a warm solution of sublimate before, during, and after the operation were probably the cause, together with cocaine, of the marked and permanent corneal opacities in 4.7 per cent. of all cases.

GUNN (336) suggests that the solution of cataract is due to the solubility of globuline in weak solutions of sodium chloride (aqueous humor). WERNER.

HIRSCHBERG (337) explains why extraction without is to be preferred to extraction with iridectomy, and gives a detailed description of his method, the preparation of the instruments, etc. He reports on sixty-two cases, among them eight with diabetes.

KAZAUROW (338) resorted to aspiration for removing soft masses of cataract in five cases. Three were cases of swelling lens-masses after division or injury, two were soft diabetic cataracts in the same individual. Bowman's aspirator was introduced through an opening which had been made with a small knife in the cornea and capsule, strict antiseptic precautions being observed. The results were satisfactory, in the diabetic cataracts even brilliant. After two days the eye was free from reaction. Kazaurow considers this method indicated in zonular cataract after division, in congenital soft cataract, in traumatic cataract, and diabetic cataract of young persons. HIRSCHMANN.

KOLINSKI (339) ascribes the changes produced by naphthaline to alterations in the walls of the blood-vessels. The changes in the lens are always preceded by those in the retina, which are themselves secondary. For details see original.

LAWRENTJEW (340) performs sphincterectomy instead of iridectomy in extraction, is very well satisfied with it, and is opposed to simple extraction without iridectomy. He had no suppuration, but in three cases V $\frac{1}{60}$. HIRSCHMANN.

MARTIN (341) is strongly opposed to the corneal suture recommended by Suarez de Mendoza. He considers it not only unnecessary but also dangerous. He is one of the few French oculists who still adhere to the combined extraction.

MARCKWORT.

NICOLINI (342) reports on ten cases of artificial ripening of cataract by trituration of the cortex after a previous iridectomy. It was attended with accidents in only two cases. In one there was considerable hemorrhage into the anterior chamber, in the other the capsule burst and part of the cortex escaped. The result of the subsequent extraction was very satisfactory in eight cases; an immediate failure occurred in only one patient, who suffered with albuminuria, and died of the kidney-disease a few weeks later. The extraction was done successfully in the eye in which the capsule burst; the patient saw when discharged, but soon lost his sight from glaucoma. DANTONE.

PANAS (343) recommends antipyrine in doses of 3 *grms* in diabetes. He extracted two diabetic cataracts with good result. In the one the sugar could not be made to disappear in any way. After giving, however, 3 *grms* of antipyrine, and enforcing strict diet, he saw the sugar, which had amounted to 30 *grms* daily, completely disappear after six days. After the operation 2 *grms* of antipyrine were given daily, and the sugar did not reappear until 150 *grms* of bread were allowed, when it amounted to 4 *grms* a day. In the second case the effect was also very satisfactory. v. MITTELSTÄDT.

PARISOTTI (344) resorted to the artificial ripening of cataract in two cases by trituration of the cortex after simple puncture of the anterior chamber without iridectomy, and was well satisfied with the result. He calls special attention to the absence of any reaction on the part of the iris, which of course had been rubbed also. DANTONE.

RISLEY (345) thinks that while cataract is a disease of advanced life, it does not depend entirely on senile change, but is due to pathological states, involving the nutrition of the eye itself. The reports of several cases are given in support of this view.

BURNETT.

After an historical review of cataract extraction, SCHIES (346) describes the method practised at the Basel clinic. He favors a flap-section at the sclero-corneal margin under strict antiseptic precautions. In the tenth and eleventh hundred he had no losses

whatever. Danger of the prolapse of iris is the obstacle to extraction without irridectomy.

STEFFAN (347) shows that in spite of all antiseptic precautions it is impossible absolutely to disinfect the conjunctival sac, and that the antiseptic bandage is therefore useless, as it cannot keep the corneal wound aseptic. In spite of antiseptic measures he had a loss of 6.6 per cent. from infection, and of 6.7 per cent. when only aseptic precautions were resorted to. Steffan makes a peripheral flat, downward flap, combined with iridectomy, and opens the capsule with a horizontal incision. Since July, 1888, he always performs a preliminary iridectomy.

SUAREZ DE MENDOZA (348) again discusses suture of the cornea after extraction (*cfr.* these ARCHIVES, vol. xviii, p. 351, No. 534). Of the numerous details, the manner in which the suture is applied is particularly interesting: at the upper end of the vertical diameter of the cornea he makes an incision in the cornea with a Graefe knife, 5–6 *mm* long, parallel to the margin, beginning on the outer side and extending inward, through about two thirds of the thickness of the cornea, and therefore not opening the anterior chamber. Into this wound he introduces a loop of silver wire, which he holds in a fixation-forceps. With the aid of a curved needle, 15 *mm* long, he passes a silk thread through the upper edge of the wound, through the loop, and then through the lower edge. The needle does not enter the anterior chamber. The points of entrance and exit are about 1 *mm* from the edge of the wound. By withdrawing the loop from the incision he also pulls out the thread in form of a loop. After cutting the silver wire the loop of thread is pushed aside, and the cataract removed in the usual manner, though the precaution must be observed of making the cataract incision coincide exactly with the one previously made. After the operation the wound is closed with two knots. If necessary one suture more is introduced on each side, though they are generally omitted. In this manner Suarez de Mendoza closed the wound after extraction in four rabbits, one dog, and fifteen human beings. The threads remained in position 5–10 days. Gayet thinks the corneal suture is principally adapted for cases with increased or diminished tension. Gillet de Grandmont and Vacher also favor the corneal suture.

MARCKWORT.

TEALE (349) has found the old flap operation more satisfactory than Graefe's operation with iridectomy. Since 1873 he performs

what he calls the "shallow flap." A Sichel knife is entered in the horizontal meridian of the cornea, and there abruptly turned forwards, producing a shallow, angular flap. He performs preliminary iridectomy in feeble patients, and when the first eye goes wrong.—Snell read a paper on the extraction of cataract with and without iridectomy: an analysis of 300 operations. The author performs a corneal incision downward without the assistance of speculum or fixation forceps. Iridectomy was performed in only one third of the operations. Eserine was used in only a few cases. Vitreous was lost in six per cent., and prolapse of iris occurred in one per cent. of the cases. Of twenty failures, eleven occurred in the iridectomy series, six in the seris without, although the former were only about a third of the latter in number.—Hewetson adopts Teale's method, and is very careful as to antisepsis. He clips the eyelashes before operating. Prolapse of the iris was very rare.—Berry described the antiseptic method he employed. The inoculation through instruments could be readily and completely avoided; it therefore remained to diminish the risk of inoculation from sources within the eye. As regards the cornea, this could be done by frequent washing of the wound during operation, making a clean cut through the cornea, without sawing movements, and guarding against bruising the edges of the incision. Septic iritis is more difficult to overcome, and a preliminary iridectomy is the best mode of avoiding it.—Little adhered to the iridectomy, and had obtained excellent results. Teale had not given his results, nor had Snell done so with sufficient detail.—Mules thought the safest method was preliminary iridectomy. He agreed with Meyer, of Paris, that there are patients who seem to carry the source of infection in themselves. —Frost's chief objection to the operation without iridectomy was the stretching and bruising of the iris; another difficulty was the clearing out of the cortex. Too much importance had been attached to the cosmetic effect. WERNER.

THORN (350) describes five cases of suppuration observed at the Greifswald clinic, and as the usual antiseptic precautions were observed, and the operations regularly performed, the suppuration must be attributed to diminished power of resistance of the tissue to the microbes, and to the impossibility of attaining strict antisepsis in operations on the eye.

DE WECKER (351) answers the paper of Alfred Graefe (*Arch. f. Ophth.*, vol. xxxiv., 3, p. 323). He is opposed to the exclusion of

iridectomy as a principle, and performs it in one third of all cases. Among 287 extractions there were 92 with iridectomy.

MARCKWORT.

DE WECKER (352) frequently found in division of congenital cataracts a tough capsule and a hard nucleus. In children with congenital cataract (not zonular) he therefore now makes an incision with a lance-shaped knife at the upper corneal margin, and seizes the anterior capsule with the capsule-forceps. If he finds decided resistance, he enlarges the wound, makes an iridectomy, and extracts as usual. In congenital cataracts he thinks division should no longer be practised.—Panas agrees with him.—Landolt and Terson oppose Wecker's opinion, as prolapse of iris readily occurs in children, and because an enlarged is always an irregular wound. MARCKWORT.

As extraction within the capsule is practicable in only a few cases, WICHERKIEWICZ (353) recommends at least the removal of as large a piece as possible. He obtained very good results with a capsule-forceps designed by himself, and made by Haertel in Breslau, and constructed after the principle of Noyes' scisssors.

WICHERKIEWICZ (354) again shows his undine for washing out the anterior chamber, and his capsule-forceps.—de Wecker remarks that he used such a forceps as early as 1871.—Galezowski regards the opening of the capsule with forceps as dangerous.—Martin recommends iridectomy and the use of the capsule-forceps. (As the ordinary capsule-forceps easily also grasps the iris when no iridectomy has been made, Wecker has given it a peculiar form, so that iridectomy is no longer necessary when this instrument is used.) MARCKWORT.

XVII.—VITREOUS.

355. RANDALL, A. On the nasal reflex crescent of Dr. L. Weiss. *Klin. Monatsbl. f. Augenhk.*, vol. xxvii., May.

356. VALK, F. Fatty degeneration of the vitreous body. *N. Y. Med. Rec.*, May 25, 1889.

RANDALL (355) saw the phenomenon in only six per cent. of myopic eyes. In two cases he could trace it, not to detachment of the vitreous, but to marked elevation of the retinal fibres at the medial half of the papilla.

VALK (356) reports a case in which there were seen in the vitreous of an eye, which seemed otherwise healthy, numerous globular, white, glistening spots, which he thinks may be due to fatty degeneration of that body. BURNETT.

XVIII.—RETINA AND FUNCTIONAL DISTURBANCES.

357. BECKER, F. A case of amblyopia due to carbon bisulphide. *Centralbl. f. prakt. Augenhk.*, vol. xiii., p. 188.

358. BRUNSCHWIG. Diplopie monoculaire. *Rec. d'opht.*, 1889, p. 468.

359. GALEZOWSKI. Du traitement du décollement de la rétine. *Soc. d'opht. de Paris*, April 2, 1889.

360. GELPKE. A case of detachment of the retina treated according to Schöler with fatal result. *Centralbl. f. Augenhk.*, vol. xiii., p. 260.

361. GUAITA. Sulla distinzione ottalmoscopica del pigmento retinico e coroideale e sulla patogenesi dell' emeralopia. *Ann. di ottalm.*, vol. xvii., 6, p. 501.

362. HIRSCHBERG, J. Degeneration of the macula lutea in old people. *Centralbl. f. prakt. Augenhk.*, vol. xiii., p. 258.

363. HIRSCHBERG, J. The variations in the width of the retinal blood-vessels. *Centralbl. f. prakt. Augenhk.*, vol. xiii., p. 203.

364. HÖSSLIN. Contribution to the diagnostic measurement of the visual field in neuroses. *Münchener. med. Wochenschr.*, 1889, No. 6.

365. LJUBINSKI, A. Ophthalmia photo-electrica. *Wjestnik Ophth.*, May–June, 1889.

366. NOVELLI. Un caso di retinite albuminurica in puerperio. *Boll. d'ocul.*, vol. xi., 14, p. 97.

367. NUEL ET LEPLAT. Troubles visuels dans l'anémie causée par le presence de vers intestinaux. *Ann. d'ocul.*, vol. ci.

368. NUEL ET LEPLAT. Amblyopie due à l'intoxication par le sulfure de carbone. *Ann. d'ocul.*, vol. ci., p. 145.

369. RAEHLMANN, E. On a pulsating aneurism of the central retinal artery. *Klin. Monatsbl. f. Augenhk.*, vol. xxvii, p. 203.

370. WESTHOFF. Iridectomy in detachment of the retina. *Kliniek voor Ooglijders*, 1889, p. 8.

BECKER'S (357) patient is a man aged sixty-six, who was engaged in the manufacture of vulcanized rubber, and who came on account of a diminution of sight, which had developed after a feeling of general discomfort. V = fingers at 3 ft. Good sight was regained after the injuries had ceased to act upon him.

Fundus normal. There was a large central scotoma, but the periphery of the visual field was not affected.

BRUNSCHWIG (358) that in a case of monocular diplopia observed by himself hysteria was the cause. A girl aged eleven, who had had convergent strabismus of the right eye for six years, with vision in it of $\frac{1}{4}$, saw double when the left eye was covered: a stick of sealing-wax held vertically before the right eye was seen as two vertical sticks, held horizontally as two horizontal sticks above each other. The distance apart of the images remained the same, no matter what was the distance of the object from the eye. With both eyes open she saw three images for a moment, though the two of the right eye were immediately suppressed. The four wafers arranged in the usual manner were seen as four in the stereoscope, therefore without binocular fusion, but without double vision of the right eye. The visual field of both eyes was decidedly contracted, that of the right more than that of the left. MARCKWORT.

On the basis of three cases GALEZOWSKI (359) recommends subretinal injection of tincture of iodine in detachment of the retina, combined with a suture of the retina with catgut.

MARCKWORT.

GELPKE (360) injected under observance of strict antiseptic precautions three drops of tincture of iodine into the preretinal vitreous space in a robust man of sixty-six, who had had detachment of the retina of the left eye for a year. Purulent choroiditis ensued, followed by acute meningitis, of which the patient died six days after the operation. A detailed anatomical investigation will be given later.

GUAITA (361) presents a detailed account of the anatomical and ophthalmoscopic condition of the choroidal pigment and the pigment-epithelium of the retina, the connection of the latter with the visual purple and the development of hemeralopia, and finally describes the successive changes of the tissue in the development of retinitis pigmentosa. DANTONE.

HIRSCHBERG (362) gives an accurate description of the well-known ophthalmoscopic appearances. In old people there is a diminution of the acuteness of central sight with full extent of the visual field. Blindness does not ensue. The ophthalmoscope shows rose-colored spots, within them white dots with crystals, more recent grayish-blue patches behind the blood-vessels, and a blackish stippling of the periphery.

HIRSCHBERG (363) calls attention to the fact that the irregularities in the width of the blood-vessels, especially in retinitis albuminurica, can frequently be observed with the ophthalmoscope before the appearance of the characteristic stellate figure. He cites three cases in support of this assertion.

HÖSSLIN (364) found that the concentric contraction of the visual field is found not only in hysteria, but also in numerous functional neuroses (intestinal neuroses, epilepsy, neurasthenia, etc.). Sector-shaped defects of the visual field are not observed in these neuroses.

LJUBINSKI (365) saw a peculiar affection of the eyes, produced by gazing with unprotected eyes at the glowing carbon points of strong electric illuminating apparatus. Gazing at them less than a minute to three minutes was sufficient to produce the affection. The author saw about 30 such cases, generally in young naval officers, who were experimenting with various illuminating apparatus. In some of them the affection was observed several times (in one nine times). It seems that a relapse easily occurs. As the exact nature of the affection is not known as yet, the author proposes to call it temporarily "ophthalmia photo-electrica." After a strong electric light has been gazed at, after-images prevail for some time; white objects seem yellowish for a while. The eyes then become quiet for the whole day (12–14 hours). Sometimes the patient can still read at night without trouble. The symptoms of the disease always appear during sleep (even during an afternoon nap). The patients awake with severe pain in the eyes, as though they were full of sand and the lids filled with quicksilver. There is profuse lachrymation, and even the slightest amount of light causes great pain. The lids and conjunctiva are swollen, the latter is much injected, marked pericorneal injection. To move the eyes is painful. Touch is not resented. The tension is not increased. The attack lasts one and one-half to three hours, sometimes longer. The patient then falls asleep and awakes the following morning with almost well eyes: no redness, no pain, no discharge, at most a tired feeling, like that after long continued reading. In some patients the symptoms reappear the following night, or even two nights, but in a much less degree. The day after the attack there is marked hyperæmia of the retina and papilla, sometimes also venous pulse. In one case, after four attacks, Ljubinski saw at the yellow spot small round yellow dots, but no corresponding scotomas. The author did not suc-

ceed in determining whether light, heat, or chemical influences played the most important part in the etiology of this affection. He looks for the seat of it both in the retina and in the cornea. He found that dark-gray glasses afforded the best protection against strong light; blue glasses are also useful. Glasses of other colors seem to be useless. Treatment consists in cold applications, instillations of cocaine and internal exhibition of chloral. HIRSCHMANN.

NOVELLI'S (366) patient, a woman aged 27, became totally blind in childbed in both eyes. Extensive retinitis albuminurica was found. After energetic general treatment, sight gradually returned to the normal, though it required more than half a year. No traces of the disease remained except a dirty-white discoloration of the papilla. DANTONE.

NUEL and LEPLAT (367) found among 81 patients suffering with amchylostomum duodenale 6 with diseases of the eye: they were neuroretinitis and retinal hemorrhages, with hemorrhages and nystagmus. MARCKWORT.

NUEL and LEPLAT (368) saw in two working-women amblyopia due to bisulphide of carbon. The characteristic feature was the high degree of amblyopia (V figures at 3 ft.) with normal visual field and color-perception. The central scotoma was very small; at the distance of the radius of the perimeter it had a diameter of only $\frac{1}{4}$ *cm.* The ophthalmoscopic changes were very slight. The edge of the papilla appeared a little indistinct. The patients completely recovered. MARCKWORT.

RAEHLMANN (369) has compiled the few communications on aneurisms of the retinal vessels and describes three cases observed by himself, one of which, that of a farm-hand aged 32, is of interest, inasmuch as the end- and periarteritic changes generally visible with the ophthalmoscope were not seen. From the position of the spindle-shaped aneurism situated upon the papilla and its relation to the distribution of the blood-vessels—rectangular forking of the central arteries upward and downward and no further division until beyond the edge of the disc—he concludes that the dilatation was due to mechanical action, and assumes that the anterior wall was unable to withstand the pressure on account of the rectangular division of the blood-vessels.

WESTHOFF (370) had treated a detachment of the retina in a man aged 35 with rest and injections of pilocarpine, without result. An iridectomy restored sight and the defect in the visual field disappeared. WESTHOFF.

XIX.—OPTIC NERVE.

371. CALDERON. Double névrite optique; kyste hydatique intra-cérébral. Its existence was shown anatomically. *Soc. Franç. d'opht.*, Aug. 9, 1889.

372. DARIER. De la suspension dans les atrophies des nerfs optiques. *Soc. d'opht. de Paris*, March 12, 1889.

373. KALT. Double névrite optique avec myelite diffuse aiguë. *Soc. Franç. d'opht.*, Aug. 12, 1889.

374. KNY, E. A case of isolated tumor of the pituitary gland. *Neurol. Centralbl.*, 1889, No. 10.

375. MEYER, P. On a case of cerebral tumor. *Charité Annalen*, vol. xiv., p. 623.

376. OPPENHEIM. A case of cerebral tumor. *Neurol. Centralbl.*, 1889, No. 10.

377. STYX. A case of otitis muco-purulenta with endocranial complications. *Zeitschr. f. Ohrenhk.*, vol. xix., p. 244.

378. SYM, G. Tumors of the optic nerve. *Brit. Med. Jour.*, Sept. 28, 1889, p. 717.

379. VALUDE. Restitution ad integrum d'une lésion optique d'origine cerebrale. *Soc. d'opht. de Paris*, March 12, 1889.

DARIER (372) advises suspension according to Charcot in tabic atrophy of the optic nerve. The improvement he obtained was probably more subjective than objective, although V is said to have risen from $\frac{1}{4}$ to $\frac{1}{3}$ and from $\frac{1}{8}$ to $\frac{1}{5}$. According to Wecker, Landolt, Gillet de Grandmont, Parninaud, and Abadie, suspension is useless in tabic atrophy of the optic nerve. MARCKWORT.

KNY'S (374) patient first came under treatment in 1882, and became blind on February 1, 1889, on account of binocular optic neuritis. Divergent strabismus, nystagmus, dementia, and epileptiform attacks afterwards developed. The autopsy revealed a round-celled sarcoma of the pituitary gland, and firm adhesions around the optic nerves, which, like the tractus, looked like diaphanous bands. No positive symptoms indicating the seat of the lesion existed.

MEYER'S (375) patient is a boy aged five, who became ill under the symptoms of cerebral pressure, had choked disc, and paralysis of the facial and abducent nerves of the right side. A peculiar chirping sound could be heard all over the skull. The autopsy revealed a very vascular glioma, which sprang from the floor of the fourth ventricle.

OPPENHEIM (376) found choked disc in both eyes of his patient. There were symptoms indicating a lesion of the left motor zone. Here a large round-celled sarcoma was found at the autopsy.

At the beginning of the third week vomiting, pain at the back of the neck, paralysis of the abducent, and moderate neuritis developed in STYX's (377) patient, both of whose eyes were affected. There was also some fever. The inflammation is supposed to have spread to the cavernous sinus, thus explaining the ocular symptoms. The paralysis had disappeared when the patient was discharged, but there was still hyperæmia of the disc.

In SYM's (378) case, a girl aged three, exophthalmus occurred suddenly during whooping-cough, a year before coming under observation. The eye was blind, a firm body prevented the return of the globe to the orbit, and a distinct tumor could be felt with the finger on the inner side. After the enucleation a growth about half the size of the eyeball was found on the optic nerve, which was removed and subsequently examined. It proved to be a sarcomatous tumor, probably arising from the fibrous tissue surrounding the nerve-bundles. No recurrence had taken place three months after removal. The author then reviews the literature of the subject: sixty per cent. of the cases occurred under twenty, the tumor was usually included in the sheath of the nerve, and though variable in character was chiefly sarcomatous or myxomatous. In fifteen cases out of sixty-nine attempts were made to remove the tumor without enucleation, in four the operation could not be completed, in five the eye suppurated, and in one death occurred; the result of trying to save the eye was not encouraging. In the cases cited there were nine recurrences and eighteen were well when last seen. WERNER.

VALUDE (379) reports a case of complete cure, in which four years previously the diagnosis of atrophy of both optic nerves had been made. The patient had been cut with a knife behind the left ear, whereupon sight gradually diminished until he could no longer walk alone. Subsequently a large abscess was found, extending from the mastoid process to Highmore's antrum. After trephining the mastoid he recovered, and V was fully restored. According to the author, there was meningo-encephalitis with descending neuritis. MARCKWORT.

XX.—INJURIES; FOREIGN BODIES (PARASITES).

380. BRIGGS, W. E. Notes on the electro-magnet in ophthalmology, with a report of nine cases. *Occidental Med. Times*, Aug., 1889.

381. LINDNER, S. Three rare cases of injury to the eyes. *Wiener Med. Wochenschr.*, 1889, Nos. 38 and 39.

382. MARSH, J. P. A case of foreign body in the orbit. *N. Y. Med. Jour.*, Aug. 3, 1889.

383. DE WECKER. Les inflammations traumatiques de l'œil. *Ann. d'ocul.*, vol. ci., p. 166, and *Soc. d'opht. de Paris*, March 12 and May 7, 1889.

BRIGGS (380) prefers a Leclanché battery of sixteen or eighteen cells to develop his magnet. In three of the nine cases only was the operation not successful. BURNETT.

LINDNER (381) successfully extracted a piece of gun-cap from the vitreous of a young man; he also reported the removal of an eyelash from a traumatic cataract, and mentions a third case in which a small piece of stone had remained in the eye fourteen years. Enucleation was performed, on account of symptoms of irritation, when extensive chalky deposits were found in the phthisical globe.

In MARSH'S (382) case a bit of steel remained in the orbit without setting up any considerable cellulitis for sixteen months. It had been probed for often, but unsuccessfully before. It weighed 51 grains, was $\frac{1}{2}$ inch in length, and $\frac{5}{16}$ inch in thickness. The retina was detached from below, involving the macula. BURNETT.

DE WECKER (383) opposes combined extraction with very problematical assumptions. According to him, inflammation is synonymous with infection. The injuries of one part of the eye are not more dangerous than those of another, provided infection be avoided. Injuries of the ciliary body are only dangerous when there is incarceration of the iris, causing scars through which infection may enter. These assumptions are energetically opposed in the discussion by Gorecki, Parinaud, and with great force by Meyer. MARCKWORT.

XXI.—OCULAR AFFECTIONS IN CONSTITUTIONAL DISEASES.

384. ARMSTRONG, S. T. Chronic interstitial hepatitis with hemeralopia, simulating cerebral hemorrhage. *N. Y. Med. Jour.*, May 25, 1889.

385. DESPAGNET. Rapports entre les maladies des yeux et les maladies du nez. *Rec. d'opht.*, 1889, No. 9, p. 513, and *Soc. Franç. d'opht.*, Aug. 10th.

386. DILLMANN, TH. On tabic eye-symptoms. From Schöler's

ophthalmic clinic at Berlin. *Inaug. Diss.*, Leipzig, A. Engelmann, 1889.

387. v. JAKSCH. Multiple disseminate sclerosis in a child of sixteen. *Centralbl. f. Nervenhk.*, 1889, No. 10, p. 318.

388. JOACHIM. On periodic paralysis of the oculomotor nerve. *Deutsches Arch. f. klin. Med.*, 1889, vol. xliv., p. 185.

389. LESZYNSKY, W. M. Localized basal meningitis and double optic neuritis. *N. Y. Med. Rec.*, April 27, 1889.

390. MOELI. On conditions found in affections of the occipital lobe. *Neurol. Centralbl.*, 1889, vol. viii., p. 439.

391. v. MONAKOW. On hemianopsia and alexia. *Correspondenzbl. f. Schweizer Aerzte*, 1889, No. 14, p. 433.

392. MULES. Trophoneurosis ophthalmica. *Brit. Med. Jour.*, 1889, p. 715.

393. NORTHNAGEL. The diagnosis of affections of the thalami optici. *Zeitschr. f. klin. Med.*, 1889, vol. xvi., 5, p. 424.

394. RAEHLMANN, E. On the changes in the retinal blood-vessels visible with the ophthalmoscope in general arterio-sclerosis, with special reference to the sclerosis of the cerebral blood-vessels. *Zeitschr. f. klin. Med.*, 1889, vol. xvi., 5–6, p. 606.

395. SAENGER, A. A case of cortical hemianopsia with autopsy. Essay read at the opening of the new Hamburg Hospital, 1889.

396. UHTHOFF. Investigations on the ocular symptoms occurring in disseminate sclerosis. *Arch. f. Psych. u. Nervenkrankh.*, vol. xxi., Nos. 1 and 2.

397. VERONESE. Report on a case of sudden blindness with normal ophthalmoscopic appearance. *Wiener klin. Wochenschr.*, 1889, No. 24.

398. WESTPHAL. An error of diagnosis in the case of a boy of nine years, who showed the symptoms of disseminate sclerosis. *Charité Annalen*, vol. xiv., p. 367.

399. WIPPLESWORTH. Optic nerve atrophy preceding the mental symptoms of general paralysis of the insane. *Brit. Med. Jour.*, Sept. 21, 1889, p. 648.

ARMSTRONG'S (384) case was that of a sailor, of forty-three years, who had marked hemeralopia, V = $\frac{10}{30}$. No change visible at the fundus. His mind began to wander, convulsions and

unconsciousness followed, and finally death ensued. No œdema of the extremities or icterus had been observed during life, yet on *post-mortem* all the characteristics of chronic interstitial hepatitis were found. Meningeal veins congested, but the brain was normal. BURNETT.

DESPAGNET (385) discusses in a very interesting paper the connection between affections of the eye and nose: persistent epiphora, which does not cease even when the lachrymal canal is permeable for the largest probes, frequently depends upon hypertrophy of the lower turbinated bones. The latter had to be treated with the galvano-cautery or saw before the lachrymation came to an end. In conjunctivitis granulosa a new attack of keratitis granulosa may develop, even in the complete cicatricial stage, on account of repeated infection from the nose. According to the bacteriological investigations and experiments of Despagnet, there is a rhinitis granulosa, which bacteriologically resembles trachoma, and is equally contagious. It is very interesting to note that he succeeded in inoculating rabbits with cultures of the granulosa bacillus. MARCKWORT.

Among the one hundred cases of tabes examined by DILLMANN (386), there were forty-one of paralysis of the ocular muscles and forty-two of atrophy of the optic nerve. Syphilis had preceded the affection in sixty-eight per cent. of all cases. Paralysis of the ocular muscles occurred as often in infected as in not infected persons. In studying the figures it must be remembered that the patients were taken from an ophthalmic clinic.

v. JAKSCH'S (387) case was marked by intention-tremor, beginning atrophy of the papillæ, very marked ataxia with enormous increase of the patellar and plantar reflexes. Nineteen cases of disseminate sclerosis in children have been described.

JOACHIM (388) found in 1885 in his patient, a woman, aged twenty-seven, complete right-sided paralysis of the oculo-motor nerve. Attacks of megrim followed, and in December, 1887, again paralysis of the right oculo-motor nerve. He agrees with Senator in assuming periodic or periodically increasing paralyses, but does not consider the former functional disturbances, but ascribes them to pathological changes, especially at the base of the brain.

LESZYNSKY (389) gives the complete history of a case of localized basal meningitis, accompanied with double optic neuritis, in a boy of sixteen, which had been followed closely for five years.

Though there was pronounced swelling of the discs, vision at no time sank below $\frac{2}{10}$, and for the greater part of the time was $\frac{4}{10}$ or $\frac{8}{10}$. The visual fields for white were normal, but contracted for colors. BURNETT.

MOELI (390) finds that in affections of the occipital lobe, beginning during the period of development, degeneration of the optic nerve ensues in man also.

MONAKOW (391) reports on a patient who five years previously had an apoplectic attack, followed by right-sided hemiparesis, right-sided hemianopsia, by alexia and agraphia. The hemianopsia was not complete, as the line of demarcation lay outside the macula lutea. The autopsy revealed various changes, depending upon the apoplexy, and explaining the loss of function. The affection of the gyrus angularis was of much interest, to the degeneration of which, from analogy with other cases, the word-blindness is ascribed.

MULES (392) proposes to include certain diseases under a more comprehensive class of "ophthalmic trophoneuroses." Experiments have shown that passive lesions, such as section of trigeminals, are not of themselves sufficient to produce alteration in the nutrition of the tissues, but that active lesions, such as neuritis, are required for this. The diseases of the eye which the author regards as due to trophoneurosis are: Corneal herpes with neuritis of frontal, lachrymal, supratrochlear or nasal nerves; solitary and multiple phlyctenulæ, corneal ulcers, simple, diffuse, and chronic interstitial keratitis, essential shrinking of the conjunctiva, scleritis, cyclitis, and lastly iritis *e. g.* gonorrhœal and gouty. WERNER.

On the basis of clinical experience and experimental physiological studies of Bechterew, NORTHNAGEL (393) years ago made the following assertion: "When in a central lesion with hemiplegia and paralysis of the facial nerve the arbitrary mobility of the facial muscles is abolished, while the participation of both sides of the face is the same in psychic emotions (*e. g.* laughing), the assumption is justifiable that the thalamus opticus and its connection with the cortex of the brain are intact." In a case which came under his observation the reverse was the case, so he concluded that the thalamus was affected, a conclusion which was confirmed by the autopsy.

RAEHLMANN'S (394) paper is based upon the clinical history of ninety cases, in forty-four of which a pathological condition of

the fundus was found. The change in general arterio-sclerosis extends (1) to the arteries. They are tortuous and thin, have a white edge, are contrasted here and there and show aneurisms of the central retinal artery and its branches. (2) To the veins. They have a white edge, are contracted at different places and show varicose dilatations. (3) Phenomena of pulsation are observed, generally in form of locomotions, rarely in form of variations of calibre. The arterial pulse is attributed to the loss of elasticity, extending the pulse into the peripheral ramifications, while the venous pulse (observed in seventeen cases) is brought into connection with the systolic and diastolic difference in pressure within the cavernous sinus. The investigation shows that the participation of the blood vessels of the eye in the similar affection of those of the brain is a common occurrence.

SAENGER'S (395) case was one of typical left-sided homonymous hemiopia, occurring in a man aged forty-six, in which the line of demarcation passed vertically through the point of fixation. The fundus was normal. The patient suddenly died and an autopsy was performed. A circumscribed lesion was found in the cortex of the right cuneus, which extended downward without any distinct line of demarcation into the lobus lingualis. There was also a fresh thrombosis of the basilar artery, and a small lesion was found in the third segment of the right nucleus lentiformis.

After an historical review UHTHOFF (396) gives the clinical histories and records of the autopsies of five patients suffering with disseminate sclerosis, whom he had for a long time under observation during life. He describes very accurately the changes in the atrophic optic nerves, and the difference between them and the tabic, as set forth by Leber and others, and the neuritic atrophies. The condition of the optic nerves, chiasm and tractus is in accordance with the views as to the nature of the disseminate sclerosis of the brain and spinal cord, and agrees particularly with the reports of Charcot and his scholars. It is worthy of notice that in some parts of the optic nerves changes were found which did not differ from these of tabic or neuritic atrophy. There is generally a proliferation of the delicate connective tissue, which can also extend to the larger septa and the inner sheath of the optic nerve. The medullated sheaths rapidly disintegrate, while the isolated or slightly covered axis-cylinders, are frequently preserved. The number of blood-vessels is increased, they are distended and their walls changed. There is generally no sec-

ondary degeneration of the fibres of the optic nerve from a lesion. Finally he discusses the different methods of staining. Uhthoff read a paper on the same subject before the Berlin Medical Society (*Berliner klin. Wochenschr.* No. 23), in which the ophthalmoscopic appearances and the visual disturbances are described. Among one hundred cases, changes in the optic nerve were found in forty-five, forty being atrophia. A normal appearance may, however, be found, even when there are very decided changes in the optic nerve and chiasm. In eighteen cases there was pallor of the whole disc, in eighteen of part of it. Pallor is of more frequent occurrence than atrophy in tabes. Total blindness in disseminate sclerosis is very rare. In six cases there was neuritis. The visual disturbances generally assume the form of a relative or absolute scotoma, the periphery of the visual being frequently not at all affected. Concentric limitation was observed in only one case, in which the optic nerve was found normal at the autopsy. In half of the cases the visual disturbance began suddenly, improvement was frequently noticed.

VERONESE'S (397) patient, a man aged sixty-four, had suddenly become blind without loss of consciousness or disturbance of motility. Ophthalmoscopic condition normal. He had two apoplectic attacks in the course of time, and after one and one half years he died. The autopsy showed chronic leptomeningitis. In the lateral ventricles there was purulent, bloody liquid; optic nerve, chiasm and tractus appeared normal.

WESTPHAL'S (398) patient, a boy aged nine, could not look up, and with difficulty to the side; slight ptosis of the eye, nystagmus and atrophic discoloration of the papillæ. Speech slow, trembling of the limbs, marked disturbance of locomotion, increase of the patellar reflex, etc. Diagnosis: disseminate sclerosis. The autopsy showed a tumor in the left thalamus opticus.

WIPPLESWORTH (399) mentions that optic atrophy is usually a late symptom in general paralysis, and relates a case in which it preceded the mental symptoms by some time. WERNER.

REVIEW.

HENRY D. NOYES, A.M., M.D. (Prof. Ophthalmology Bellevue Hosp. Coll., Executive Surgeon N. Y. Eye and Ear Infirmary). *A Text-book on Diseases of the Eye*, 733 large octavo pages, illustrated by 6 chromo-lithographic plates, 5 plates in black, and 236 wood-engravings. New York, Wm. Wood & Co., 1890.

The book before us is a brilliant testimonial of the extensive knowledge, vast experience, untiring industry, and literary ability of its celebrated author. It presents the actual stand-point of ophthalmology more completely than any other text-book in the English language. Not too voluminous for the student of medicine, it is exhaustive enough for the practitioner who seeks information on rarer forms of disease. Most welcome, however, will it be to the eye specialist. The whole field of ophthalmology, in its various departments, is treated of harmoniously and with singular clearness. Everywhere we recognize the author's desire to do justice to all subjects of scientific and practical importance, but to avoid speculative discussion. The book is truely brought up to the day and the connoisseur readily notices that the author is one of the best-read oculists, his quotations rarely being taken from other text-books, but chiefly from the sources of modern scientific progress, monographs and periodicals.

Dr. Noyes' text-book contains the essentials of the anatomy and physiology of the visual organ, including that portion of the brain which has ocular relations. The methods of examination and the errors of refraction and motility are clearly described. The organic diseases, their medicinal and operative treatment, form the bulk of the book. All the points of importance, especially in the pathology of the inner tunics, the optic nerve and brain, are illustrated by numerous drawings. Due notice is taken of all the advances in ophthalmology, be they in its own sphere or in connecting branches, such as bacteriology, neurology, and general surgery.

We can highly recommend Dr. Noyes' text-book to every one who, in any way, studies or practises ophthalmology.

MISCELLANEOUS NOTES.

THE INTERNATIONAL MEDICAL CONGRESS will meet at Berlin August 4 to 9. The general sessions will occupy three days; the ophthalmological section will meet on the three intervening days, and the following subjects have thus far been chosen for discussion: (1) trachoma; (2) sympathetic ophthalmia; (3) influence of the electric light upon the eye.

DR. DA GAMA PINTO, for many years the assistant of Prof. Otto Becker at Heidelberg, has been appointed Professor of Ophthalmology and Director of the Ophthalmic Clinic of the University of Lisbon.

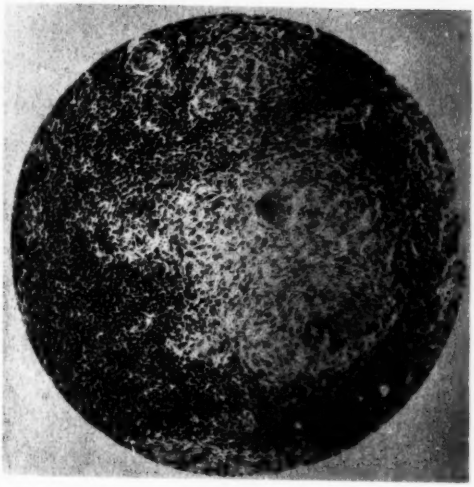
DR. W. F. DENNETT and DR. J. E. WEEKS have been appointed surgeons at the N. Y. Eye and Ear Infirmary; DR. CH. F. MAY, Chief of Clinic in the Ophthalmic Department of the Vanderbilt Clinic; DR. F. HAMILTON WEIR, Assistant Surgeon to the N. Y. Ophthalmic and Aural Institute; DR. E. FRIDENBERG, Visiting Ophthalmic Surgeon to the Harlem Hospital.

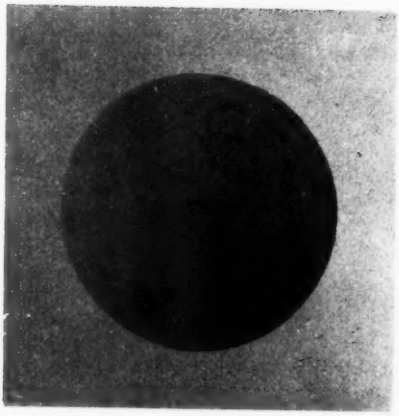
DR. STIRLING D. KENNEDY has resigned the position of Lecturer on Diseases of the Eye and Ear in the Tulane University, New Orleans, and DR. W. C. AYRES has been elected to fill his position.

DR. A. VOSSIUS, of Königsberg, has been appointed Professor of Ophthalmology at the University of Giessen, Germany.

FIG. 1.

FIG. 2.





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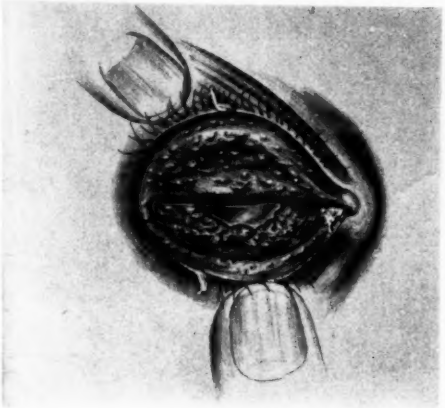

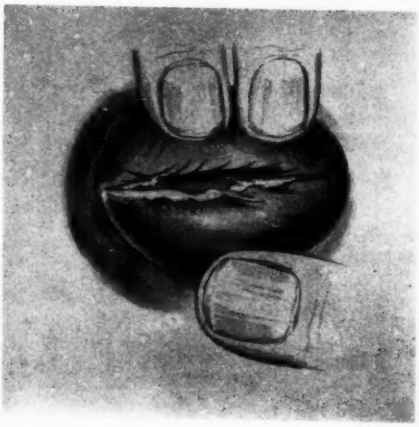

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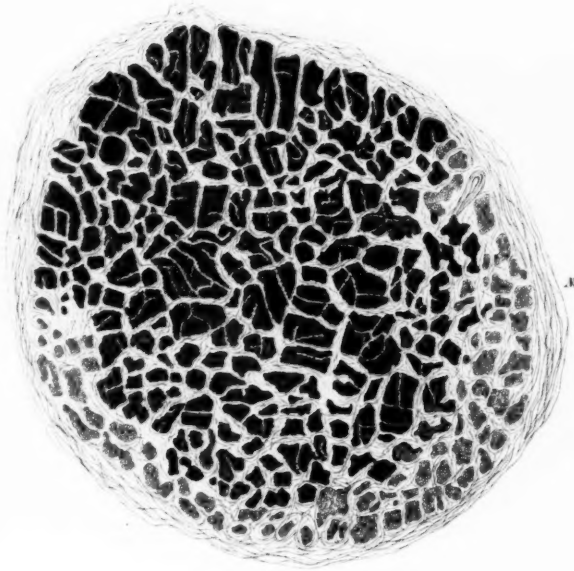

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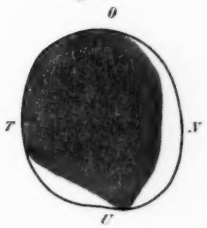

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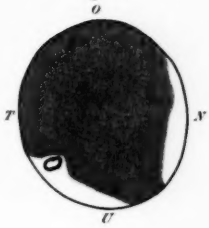

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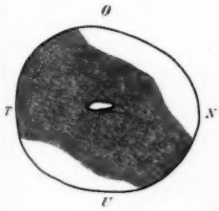

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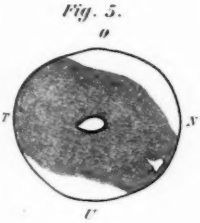

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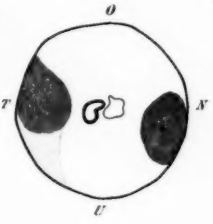

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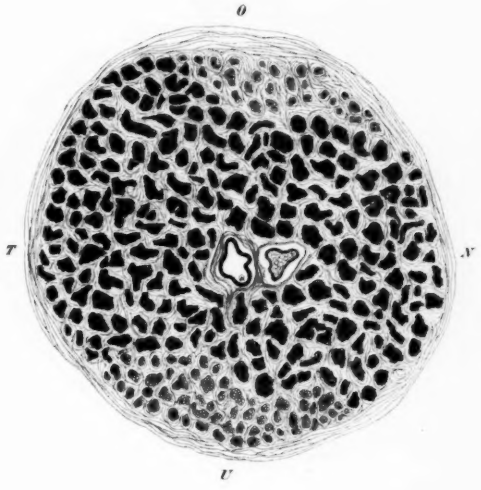

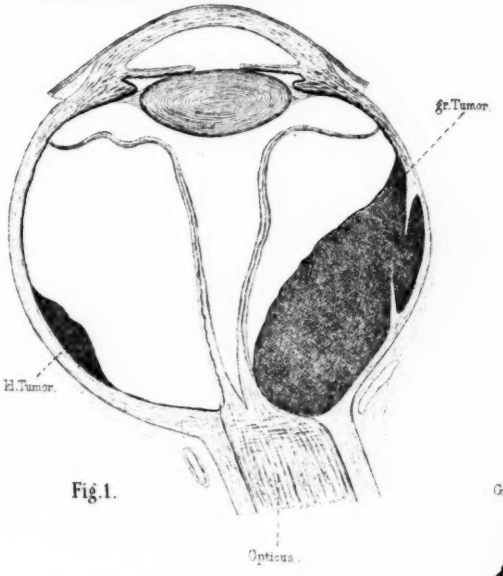

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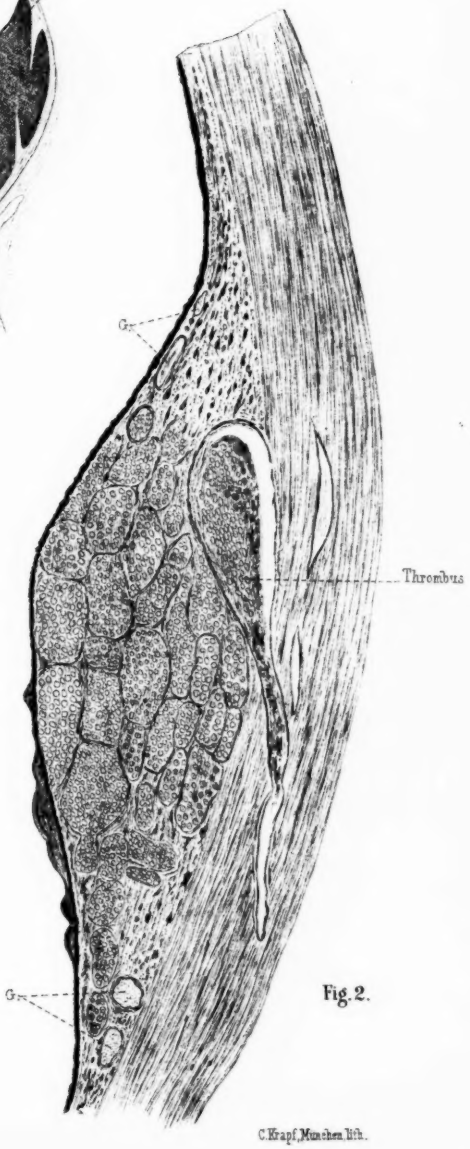

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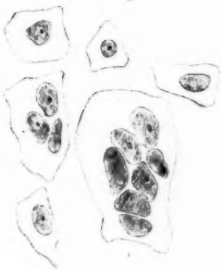

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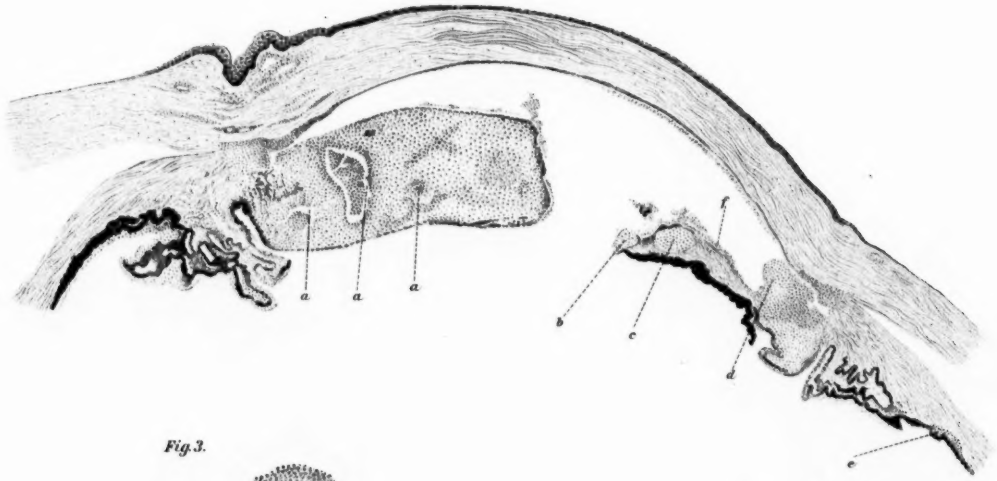

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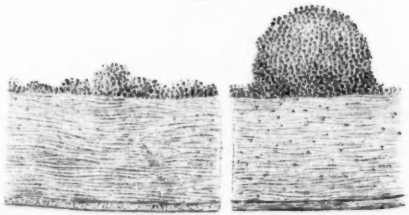

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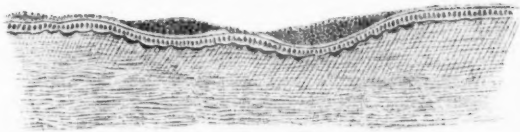

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